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ABSTRACT

This CD-ROM disk contains a curriculum on vector communication for students with moderate and severe multiple disabilities. Section 1 discusses pragmatic communication, functional analysis of behavior, augmentative and alternative communication, including gestures and signs, use of pictures and pictographs, and low, medium, and high tech communication devices. Milieu methods for teaching communication such as modeling, mand-model, time-delay and incidental approaches are also discussed. Methods for teaching initiating, maintaining, and terminating conversations are described. There is a discussion of communication and hearing impairments describing development of speech sounds, use of hearing aids, and the Six Sound Hearing Test. Special considerations regarding communication of learners who are deafblind are also reviewed. The final part describes communication technology and computers, adaptations to improve computer access and use, and Microsoft Windows and Apple resources for people with disabilities. Section 2 provides an extensive list of task-analyzed learning indicators in various areas of communication performance. These behaviorally defined indicators provide explicit statements of learning outcomes that are designed to be useful in developing Individualized Education Programs. The curriculum may be opened on Microsoft Windows or Mac OS platforms using Adobe Acrobat Readers. Two versions of Acrobat Reader are stored on the disk. (CR)

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VECTOR COMMUNICATION CURRICULUM: MODERATE AND SEVERE, MULTIPLE DISABILITIES

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PREFACE

The *Vector Communication Curriculum for Moderate and Severe, Multiple Disabilities* is divided into two sections. Section One, *Planning for Communication Assessment and Instruction* discusses: pragmatic communication, functional analysis of behavior, augmentative and alternative communication including gestures and signs, use of pictures and pictographs; and low, medium and high tech communication devices ranging from communication wallets and boards to scanners and voice synthesizers. Mileau methods for teaching communication such as modelling, mand-model, time-delay and incidental approaches are also discussed. Methods for teaching initiating, maintaining and terminating conversations are described. There is a discussion of communication and hearing impairments describing development of speech sounds, use of hearing aids and the *Six Sound Hearing Test* (Ling, 1989). Special considerations regarding communication of deafblind learners are also reviewed. The final part of Section One describes communication technology and computers such as technology and visual impairments, and adaptions to improve computer access and use, as well as *Microsoft Windows* and *Apple* resources for people with disabilities.

Section Two, *Communication Domain, Learning Indicators* provides an extensive list of task-analyzed, learning indicators in various areas of communication performance. These *behaviorally defined indicators* provide explicit statements of *learning outcomes* that can be easily selected for copying and pasting into student IPPs. Some of the lists of indicators describe each of the steps in actual instructional programs illustrating how to teach and test student skill acquisition. Indicators are provided as instructional outcomes and as learning indicators for pragmatic communicative functions such as making and responding to requests, expressing protest or rejection, or affirmation and acceptance. Also listed are the competencies required to use signs and gestures, objects, pictures, pictographs, and other methods of pre-symbolic and symbolic communication. The skills needed to use direct, assisted and electronic scanning of communication displays are also listed as are the competencies required to initiate, maintain and terminate conversations.

Throughout the curriculum, teachers and others are directed to various communication programs, testing and teaching materials, and manufacturers and suppliers of equipment. An extensive list of suppliers, manufacturers and organizations related to augmentative and alternative methods of communication is provided in the Appendix. In addition, selection of any one of many *Hot Buttons* located throughout the text automatically link the reader to a wealth of additional information located at numerous excellent Web sites located throughout the world.

USING THE CURRICULUM

The curriculum may be used in several ways.

1. Since the curriculum is in *Adobe PDF* format and since the CD includes *Adobe Acrobat Reader*, used to read PDF files, the curriculum can be opened on all Mac

OS, Microsoft Windows and UNIX platforms.

2. Thus, if desired, the entire curriculum can be printed for review (one copy only for personal use of the original *registered* purchaser of the curriculum). Sections of the curriculum related to assessment and instruction can be printed and circulated among staff to stimulate discussion, development and coordination of programs.

3. Since the curriculum includes a detailed *cross-referenced index*, users can readily locate information of interest.

4. Using the *Copy-N-Paste* function, users can easily move precise, behavioral statements of *Learning Indicators* from the curriculum to prepare *Individual Program Plans (IPPs)*.

TABLE OF CONTENTS

ACKNOWLEDGMENTS 3
PREFACE 4
TABLE OF CONTENTS 6
PLANNING FOR COMMUNICATION ASSESSMENT AND INSTRUCTION 11
PRAGMATIC COMMUNICATION 11
RECOGNIZING AND RESPONDING TO NON-SYMBOLIC COMMUNICATION 12
FUNCTIONAL ANALYSES OF BEHAVIOR 13
RECEPTIVE COMMUNICATION 13
EXPRESSIVE COMMUNICATION 13
TEACH COMMUNICATION SKILLS IN NATURAL SETTINGS 14
AUGMENTATIVE/ ALTERNATIVE COMMUNICATION 14
Unaided Methods of Augmentative/ Alternative Communication (AAC) 14
Gestural Communication 15
Natural Gestures. 15
Formal Gestural Communication Systems 15
Finger Spelling. 15
White's Gestural System for Lower Extremities. 15
Gestural Languages 15
Amer-Ind. 15
American Sign Language (ASL). 16
Signed Exact English (SEE). 16
Deaf/Blind Manual Communication. 16
Gestures and Signs 17
Sign and Symbol Vocabulary Selection 18
Sign Selection According to Motoric Difficulty 19
Sign Iconicity 21
Using Signs 21
Gestures/Signs and Speech Production 23
Aided Methods of Augmentative/ Alternative Communication (AAC) 24
Object Communication 24
Representational Symbols Communication 24
Black and White or Color Photographs. 24
Simple, Black and White Line-drawings. 25
Picture Communication Symbols (PCS). 25
Pictographic Ideogram Communication (PIC). 25
Picysms. 25
Rebus. 26
Sigsymbols. 26
Blisssymbols. 27
PECS (or Picture Exchange Communication System). 27
Logos. 28
Makaton Vocabulary. 28
Selecting Symbol Types 29

Communication Devices 31
Information Sources 31
Low Tech Communication Devices 31
Tangible Symbols. 31
Pictures. 31
Photo Boards. 32
Schedule or Calendar Boxes. 32
Communication Books. 32
Communication Vests. 32
Communication Charts. 32
Communication Cards. 33
E-TRAN (Eye TRANsfer) Frames. 33
Communication Wallets. 33
Folding Communication Boards. 33
Conversation Displays. 33
Medium Tech Communication Devices 33
Pointer Boards. 33
Switches Activated Voice Recordings. 34
High Tech Communication Devices 34
Sources of Information. 34
Clock Communicators: Scanning Communication Aids. 35
Comboard. 35
Dial Scan. 35
Electronic Scanning Communication Devices 35
Zygo Model 16C. 35
ScanPAC. 35
Electronic Keyboard Operated Communication Devices 35
Canon Communicator. 35
Real Voice. 36
Talker 11. 36
Voice Output Communication Systems 36
MessageMate. 36
Talking Screen. 36
AlphaTalker. 36
Photodetection Devices 36
VisionKey. 36
Print to Speech Devices 37
Kurzweil Personal Reader. 37
Print to Braille 37
Duxbury Braille Translation. 37
Vibrotactile Communication Devices 37
Tactaid 2000. 37
LTD (Little Tactile Device). 37
OSCAR (Optimal Speech Communication Assistance for Residual Hearing). 37

Tactilator 38
Using Multiple Forms of Communication 38
Enabling Switches 42
Mileau Methods for Teaching Communication 44
Modelling Procedure 44
Mand-Model Procedure 45
Choice-Making Mands. 45
Time Delay Procedure 45
Incidental Teaching 46
Teaching Conversations Skills 47
Initiating Conversations 47
Maintaining Conversations 48
Conversational Turn-Taking 48
Terminating Conversations 49
Communication and Hearing Impairments 49
Speech Sounds 49
Hearing Aids 50
The Six Sound Test 51
Checking Student Hearing Aids Using the Six Sound Test 51
Communication and Visual Impairments 52
Deafblind 52
Communication Technology/Computers 54
Information Resources for Blind and Visually Impaired 54
Computer Access Products for Blind & Visually Impaired Users 55
Keyboard Modification Programs 55
Speech Synthesizers and Speech Input Systems 55
Head-Pointers, Light-Pointers and Mouth-Sticks 56
Adaptations to Computers 56
To Improve Access. 56
When a User Has Difficulty Using a Mouse. 57
When a User Has Difficulty Using the Keyboard. 58
Discover: Board/ Discover: Screen. 59
IntelliKeys Keyboard. 59
Unicorn Expanded Keyboard. 59
When a User Cannot Read Text or Graphics. 59
Microsoft Windows Resources for People with Disabilities 60
Apple Resources for People with Disabilities 61
COMMUNICATION DOMAIN LEARNING INDICATORS 62
PRAGMATIC FUNCTIONS 62
Attending (Eye-Contact) 63
Attracting Attention 64
Making Requests 65
Indicates "Want" 65
Indicates "What's that?" or "Who is that?" 66
Expresses Negations, Protests, Rejects 67

Function of Protest 67
Form of Protest 67
Responds to Requests 69
Supplies Requested Information 69
Makes Choices. 69
Responds to "Where is ___? Questions. 70
Expresses "Don't Know." 70
Complies with Request 70
Follows One- and Two-Step Instructions 70
Describes in Response to Request 72
Names Objects or Events 72
Describes Locations, Directions, Times 73
Describes Personal State, Beliefs, Attitudes, Emotions, Discomfort Injury and Fatigue
Provides Affirmation 74
Comprehends a Converser's Non-Symbolic Communication 74
AUGMENTATIVE/ ALTERNATIVE COMMUNICATION 77
Gestural Communication 77
Expressive Gestures 77
Attention Seeking Gestures. 77
Acceptance Gestures 78
Acknowledgement Gestures. 78
Rejection Gestures. 78
Indicating Want Gestures. 79
Requesting Assistance Gestures. 79
Receptive Understanding of Gestures 79
Uses Signs for Communication 80
Pre-Signing Motor Skills 80
Prehension Patterns. 80
Unilateral/Bilateral Patterns. *80*
Developing use of Objects for Communication 81
Developing the use of Pictures/Photographs for Communication 83
Using Line-Drawings/ Pictographs for Communication 83
Other Activities Related to Communicating with Pictographs 88
Using Miniature Representations for Communication 88
Other Activities Related to Communicating with Miniatures 88
Using Blissymbols for Communication 89
Other Activities Related to Communicating with Blissymbols 91
Using Parts of Objects for Communication 91
Other Activities Related to Communicating with Parts of Objects 91
Using Textured Materials for Communication 92
Other Activities Related to Communicating with Textures 92
Using Product Logos or Labels for Communication 93
Other Activities Related to Communicating with Logos 93

Using Printed Words for Communication 94
Other Activities Related to Communicating with Printed Words 94
Using Communication Boards for Communication 95
Using E-Tran Eye-Pointing/ Light-Pointer 96
SCANNING AND SELECTION OF DISPLAYED COMMUNICATION ITEMS (OBJECTS, PICTURES OR SYMBOLS) 96
Direct Selection 97
Visual Scanning and Direct Selection 98
Auditory Scanning and Converser Assisted Selection 99
Visual Scanning and Converser Assisted Selection 100
Electronic Scanning 100
USING SWITCHES IN COMMUNICATION 101
Step Element Scanning 101
Automatic Scanning 102
Inverse Scanning 102
Circular Electronic Scanning 105
Linear Electronic Scanning 105
Row and Column Electronic Scanning 107
Category/Page-Item Electronic Scanning 108
Directed Electronic Scanning 110
TACTILE COMMUNICATION WITH DEAFBLIND LEARNERS 110
SPEECH SOUNDS 112
EARLY LANGUAGE DEVELOPMENT 115
CONVERSATIONS 119
Initiates Conversation 119
Responds to Initiations 120
Conversational Turn-taking 120
Maintains Conversation 121
Conversational Repairs 122
Terminates Conversation 122
JOINT-ATTENTION 123
Uses Non-symbolic Communication to Get Joint-Attention to an Object or Event 124
OTHER COMMUNICATIVE CONSIDERATIONS 124
Aesthetics 124
Telephone 125
APPENDIX A 127
SUPPLIERS, MANUFACTURERS AND ORGANIZATIONS RELATED TO AUGMENTATIVE AND ALTERNATIVE METHODS OF COMMUNICATION 127
Sources of Information 127
REFERENCES 136
INDEX 142

PLANNING FOR COMMUNICATION ASSESSMENT AND INSTRUCTION

PRAGMATIC COMMUNICATION

The skills listed in the communication curriculum that follows are not those of a *language curriculum* focussing on syntax, vocabulary and parts of speech, but are the skills required in *Pragmatic Communication.*

Pragmatic communication is *functional* communication in a social context in which an individual uses verbal and/or nonverbal *forms* of communication to influence the people with whom he or she is interacting so that they will perform particular *functions* or serve particular purposes desired by the person initiating the communication. Pragmatic communication, according to Orelove and Sobsey (1996), is defined by its effect upon people in the environment.

The *functions* or purposes served by communication may include, for example, stopping or removing an undesirable activity or object, starting or offering a desired activity or object, or giving attention or information to the individual.

The *verbal and non-verbal forms* of the communication, used individually or in combination, may include the use of signs, symbols or pictures, gestures, facial expressions, body language, physical contact, speech synthesizers, speech sounds and/or words.

Pragmatic communication is demonstrated in the following example in which a student in a classroom repeatedly scratches his arm. The *form* of the communication is gestural, arm scratching, the *content* of the communication, inferred from past observations of the child is, "I'm frustrated. I need help." The *function* or purpose served by the communication, is to elicit the teacher's offer of assistance to complete the task successfully. The idiosyncratic form of communication used in this example illustrates the need to consider communication in terms of the skills of both the transmitter and the receiver. Some idiosyncratic forms of communication may be readily understood by people familiar with the individual, but may be completely incomprehensible to strangers (Neel & Billingsley, 1989).

According to Neel and Billingsley (1989), many children with moderate to severe multiple disabilities, unable to speak because of sensory, neuromuscular or intellectual disabilities, including persons having cerebral palsy, autism, mental retardation or hearing loss/deafness fail to develop an adequate language system. Nevertheless, these individuals are able to communicate effectively with others. It is not necessary to have an elaborate language system to be an effective communicator.

RECOGNIZING AND RESPONDING TO NON-SYMBOLIC COMMUNICATION

Students having severe disabilities who make a slight movement, gasp or startle, hit an object or make an unusual noise may be communicating thoughts and feelings. Unfortunately, research suggests adults may find it difficult to recognize behaviors of this nature as attempts to communicate. Many efforts to communicate go unrecognized. However, once a behavior is recognized as an attempt to communicate, if a communication partner consistent pairs a response to the learner's behavior, the student can be taught that his or her behavior is a functional method of communication (Downing, 1999).

Non-symbolic communication may take various forms:

- *changes in facial expression*, such as turning eyes, head and/or body toward or away
- *gazing* at a person or object
- *gesturing:* pointing, waving, nodding, reaching for, pushing away, giving or displaying objects to someone, holding one's arms out
- *touching:* holding, grabbing, pulling someone toward an object or activity
- *body tone:* relaxing or tensing
- *activity level:* squirming, quietening
- *verbalization* (not speech), for example, yelling, crying, laughing, gurgling

It is essential to attend to non-symbolic communication of this nature because, a) these forms of communication may be the primary or only way that individuals with severe disabilities communicate, and b) these forms of communication are a developmental precursor to higher levels of communication. The responsiveness of caregivers to non-symbolic communication plays a critical role in developing communication skills (Goetz & Hunt, 1994: Siegel & Wetherby, 2000).

Teachers must be sensitive to each student's attempts to communicate. Teachers, teaching assistants, parents and others must be able to identify and interpret communicative attempts and respond in a manner that indicates to the learner that they are interested and willing to become communication partners. Receptiveness for communication can be conveyed by smiling, speaking in a soft, warm tone and gently touching the student. Students who have limited verbal communication may be particularly sensitive to non-verbal messages sent by teachers and others in the learner's environment (Kaiser, 2000).

Some forms of communication may be very effective for an individual in some contexts with some people, but the subtlety and idiosyncratic nature of the forms may not be broadly understood. Teachers must be aware of the variety and combination of forms each student uses and attempt to teach forms of communication that will be more broadly understood by various people in a variety of contexts (Downing, 1999).

FUNCTIONAL ANALYSES OF BEHAVIOR

Because individuals who have severe and profound, multiple disabilities frequently have so few means of communication, and because it is often so difficult for them to learn to use each new form of communication, these individuals may use non-compliance and self-injury as methods of communication. It is important that caregivers come to regard *problem behaviors* as possible attempt to communicate. *Functional analyses of the communicative intent of behavior* should be an integral part of each student's program. A functional analysis involves systematic observation and data recording to determine where, when and under what conditions specific behaviors characteristically occur. For example, where and when does a child often begin to head-bang? After repeated observations, hypotheses are formed regarding the purpose or function of the behavior. For instance, if head-banging often follows long periods of inactivity, the communicative intent of head-banging may be "Pay attention to me," or "Give me some stimulation." Alternatively, a student may bang his/her head when asked to do something. In this case, head banging may be intended to communicate "Leave me alone," or "This task is too difficult for me." These hypotheses can be tested and if validated, the student may be taught more effective/acceptable ways to communicate the same messages to a broad variety of people and conditions. O'Neil, Horner, Albin, Sprague, Storey and Newton ((1997) have provided an excellent guide, *Functional Assessment and Program Development for Problem Behavior.*

RECEPTIVE COMMUNICATION

Among individuals with severe, multiple disabilities, receptive communication skills may be revealed by a smile or laugh in response to a funny event, a frown when teased by another student, or looking toward the computer or raising one's hand when asked "Who wants to work on the computer?" All of these behaviors indicate understanding of a communication. Depending on the nature or severity of one's disability, it may be difficult to express receptive communication and the resulting attempts may be very subtle and idiosyncratic. Therefore, to obtain a comprehensive picture of each student's receptive skills, it may be desirable to sample behavior in a large number of environments and activities (Downing, 1999).

EXPRESSIVE COMMUNICATION

Expressive language skills may also be very idiosyncratic. Throwing or spitting food, may be an attempt to say, "I'm full," "I don't like this stuff" or "Pay attention to me." To avoid the risk of overlooking a student's subtle or obscure attempts at expressive communication, service providers should form the habit of putting words to the student's efforts. For example, when Ariel starts to rock back and forth in her seat, her teacher, based on observations of Ariel's behavior in a variety of situations, might respond by asking "Is Ariel bored?" Consistently labelling Ariel's behavior in this manner may help teaching assistants and Ariel's classmates to interpret the communicative intent of her behavior (Downing, 1999).

TEACH COMMUNICATION SKILLS IN NATURAL SETTINGS

Communication skills should be taught in natural settings where and when they are required rather than during separate communication training sessions. For example, rather than teach a learner in isolation to imitate speech sounds, to label photographs or objects, or to point to a cup on his/her communication board to indicate *drink*, language instruction should be integrated into naturally occurring, daily activities. For example, teach the individual to point to a cup during breakfast, snack, lunch and dinner at home and at school. Teaching in natural settings avoids the need to generalize learning from a teaching environment to a natural settings. Teaching across several settings enhances both generalization and maintenance of learning. It is critical that students be given repeated opportunities to practice communication skills in all environments: home, school, recreational and vocational.

AUGMENTATIVE/ ALTERNATIVE COMMUNICATION

Many individuals with multiple disabilities do not develop speech or develop only very limited speech. Communication training programs for these individuals must focus on augmenting modes of communication. Even when learners have developed more advanced speech, augmenting or supplementing their verbal skills with gestural and graphic modes can enhance their functioning.

Augmentative communication refers to the use of methods that temporarily or permanently *supplement* existing verbal communication. These aids or techniques are commonly used by individuals having severe or profound mental retardation, multiple disabilities, autism or severe/profound communication deficits resulting from deafness or blindness.

Alternative communication refers to communication methods used by individuals having no vocal abilities and include the use of natural gestures, gestural language and sign language. Usually a single alternative or augmentative communication method will not meet all of an individual's communication needs. Most individuals use a combination of both aided and unaided techniques to communicate with different people in various situations. For example, depending on variations in conditions, an individual may use pictorial communication in one situation and gestural communication in another. These two methods of communication and others my be used singly or in combination to convey the same or different types of information.

Unaided Methods of Augmentative/ Alternative Communication (AAC)

Unaided methods of augmentative and alternative communication (AAC), such as gestures, sign languages, body language, pantomime and vocalizations require no equipment. *Aided* communication, such as the use of objects, photographs, pictures, drawings, pictographs, graphic representations of signs, Braille, and synthetic speech, discussed below, requires some form of assistive technology.

Gestural Communication

Figure 1. Gestures

Gestural Communication involves body and hand movements such as pointing, reaching and miming, facial expressions such as smiling or frowning, eye movements and head movement such as nodding, shaking to indicate "Yes" or "No," and turning away or casting one's head down. These commonly found gestures are referred to as *natural* whereas some gestures are *idiosyncratic*. For instance, an individual may flail her hands at the side of her head to indicate "Stop," "No more" or "Go away."

Natural Gestures. Hamre-Nietupski, Stoll, Holtz, Fullerton, Ryan-Flottum and Brown (1977) described a set of gestures commonly used and generally understood among learners having severe mental retardation. These gestures are highly recognizable in the general community. Although a limited vocabulary, this set of gestures may provide a good starting point for a functional, gestural communication system for learners having severe disabilities.

Formal Gestural Communication Systems

Fingerspelling. Fingerspelling includes 26 distinctive hand shapes representing the letters of the alphabet. Functional use of fingerspelling requires a) the motor skills to make the 26 distinctive hand shapes, b) the skills required to spell the variety of words needed for effective communication, and c) the ability to recall both how to spell and how to make each of the hand shapes.

White's Gestural System for Lower Extremities. This method involves 125 leg signs using legs, toes, heels, knees, thighs, ankles and calves to convey messages (Huer, 1987). The method may be useful for persons having control of their lower extremities and lacking speech, use of the upper extremities and the ability to select communication symbols by gazing.

Gestural Languages

Amer-Ind. Amer-Ind is based on Native American Indian hand-talk (Skelly, 1979), a system initially developed to permit tribes speaking different languages to communicate with each other. Amer-Ind includes 250 signs equivalent to 2,500 concepts. These pictographic signs are commonly used with individuals having severe disabilities. Many of the signs are simple and can be formed with a single hand. Skelly's book provides a sign dictionary illustrating the form and movement of each hand signal and lists the various meanings each sign can have in different circumstances. For example the word *add* is illustrated as the forefingers of two hands crossed to make a plus sign. In various situations the sign may be mean: *account, addition, bill, compute, include, plus, sum, supplement* or *total*. *Help* shows the fingers of two hands interlaced. *Walk* shows the forefinger and middle finger of one hand making a walking motion like legs. *Heavy* shows the fist of one hand being placed on the palm of the other hand which is then lowered several inches. Research

indicates that the ability of naive person to guess the meaning of these signs ranges from 50 - 80% (Westling & Fox, 2000).

American Sign Language (ASL). AMESLAN has its own grammar, linguistic structure and vocabulary - a separate language, completely independent from English. Sign languages are not universal - different sign languages are used in different countries. For example, British Sign Language is used in Britain. Only about 10% of the signs in the languages used in various countries are common. The meaning of < 20% of ASL signs can be guessed from the visual characteristics of the signs (Reichle, 1991).

Visit the ASL site at | http://where.com/scott.net/asl/ |

Signed Exact English (SEE). SEE uses signs, many taken from Ameslan and from finger spelling to represent the order, syntax and grammar of the English Language. SEE is parallel to spoken and printed English. Although ASL is the language used most by adults in the deaf community, SEE signs may be more widely used in the younger deaf community (Goetz & Hunt, 1994). The biggest user group consists of deaf and hard-of-hearing children and their parents, families, friends and teachers. Reportedly, children born with hearing loss can learn signs at the same rate as hearing children learn spoken words. Children who are deafened at a later age also reportedly benefit from SEE. A second user group of considerable size are people having language delays. Included in this group are hearing, but basically non-verbal, children who are severely, moderately or profoundly retarded, aphasic, cerebral palsied or autistic. For this group, SEE reportedly provides a means for communication when spoken language is not feasible.

| http://www.seecenter.org/ |

Deafblind Manual Communication. The *A-Z to Deafblindness* Web page listed below provides an excellent pictorial and prose description of the deafblind manual alphabet. In addition, information is provided about resources, organization, equipment and conferences for and about people with deafness, blindness and deafblindness. Information is also provided about the *English Deafblind Manual Alphabet* involving the spelling of capital letters on the palm of the receiver's hand, and Tadoma, a method of tactile speechreading. A *Tadoma* user feels the vibrations of the throat and face, and the position of the jaw of a speaker.

| http://www.deafblind.com/card.html |

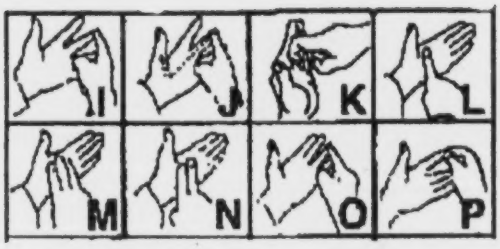

Figure 2. Deafblind Manual Alphabet

Gestures and Signs

Manual signs, as used in a sign language, differ markedly from gestures in a number of ways: signs show a disassociation with speech; demonstrate utterance like timing; occur in combination conveying more than one unit of meaning; are segmental, and the forms they take are convention based (Grove, 1997; Powell, 1999).

An extensive body of literature demonstrates successful teaching of gestural communication to learners with multiple disabilities and autism (Mustonen, Locke, Reichle, Slorack & Lindgren, 1991).

Advantages of gestural language: no equipment; portability; the meaning of gestures is frequently transparent (e.g., gesture for cutting with scissors); communication is rapid; there is no need to sort through a graphic display; user can communicate over a distance; the iconicity of signs and gestures makes them easier to learn than is spoken language.

Disadvantages of sign communication: memory requirement - users must be able to recall and produce a relatively large number of signs to communicate. In contrast, the memory requirements of a graphic mode are minimal as one can simply select from a graphic display. Also, although the duration in which signs are exposed can be extended for longer periods than one can extend speech, there is still no lasting display of the signed message as there is with graphic communication (Mustonen, Locke, Reichle, Slorack & Lindgren, 1991).

Although manual signs are the most often reported form of augmentative communication used by persons having severe or profound retardation, evidence suggests that these individuals may never learn a comprehensive sign vocabulary and that spontaneous use of signs seldom occurs (Goetz & Hunt, 1994). Furthermore, signing rarely suffices as a complete communication system. Combinations of speech and aided, alternative and augmentative communication should be considered.

Sign and Symbol Vocabulary Selection

Signs selected should be based on an ecological inventory of communication demands placed upon the individual in the various environments in which he or she characteristically interacts. Signs that are functional for the individual and serve frequent communicative demands should be identified and taught. The ecological analysis described below has been adapted from Arvidson & Lloyd (1997) and the Purdue University Technical Assistance Team.

1. Identify specific home, school, work and community environments within which the individual performs; homes may include own home, friends' homes, group home, parents' home; school may include classroom, playground, cafeteria, hallway, etc.

2. Note the amount of time spent in each environment and the types of communicative activities and task demands.

3. Rank order the environments in terms of communicative priority with respect to the amount of time spent in each environment and the frequency, complexity and importance of communicative demands in those environments. Perform observations in these environments and interview *learners* and their communication partners.

4. Record the vocabulary required by the communicative demands in these environments. Downing (1999), suggested that communication can generally be classified into four main categories:

    a. wants/needs: "Yes," "No," "Give me ..." "Want toilet/drink" "Don't want __." Requests for food, activity and people;

    b. information sharing: asking and answering questions;

    c. social closeness: getting the attention of other people; interacting in positive ways, and

    d. social etiquette: "Please." "Thank you." "Hello." "Goodbye."

5. List single words, phrases, sentences and longer utterances.

6. Rate and rank order the vocabulary from least to most important on a scale from 1-4. When rating, consider frequency of use and the functional value of the word, phrase or sentence.

7. Initially introduce the terms of highest rating.

Sign Selection According to Motoric Difficulty

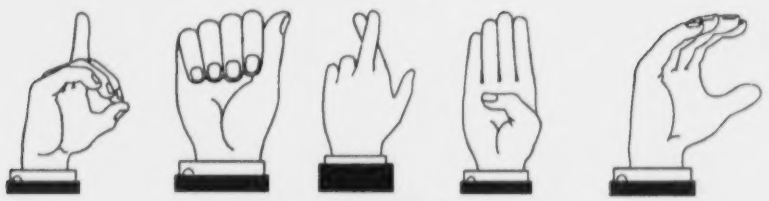

Figure 3. Manual Signs

When selecting and organizing the order in which to teach signs, Dunn (1982) recommended that a learner's motoric abilities should be considered. According to Dunn, it is *motorically easier* to make signs having the following characteristics.

1. Movements of the arm is toward rather than away from the body; thus the signs for *want, nose, love* and *eat* are easier to make than are the signs for *thank you, give, stay* and *bad.*

2. Movement of the *arm and the palm* is *toward* the face as in *sour, candy, pretty* and *sad,* compared to the signs for *listen, ear,* and *horse* in which movement of the arm is *toward* the face but the *palm is away* from the body.

3. Movement of the hands is toward the midline as in the signs for *shoe, close, more* and *stop* rather than away from the midline as in *large, eggs, ready* and *different.*

4. The signs involve touching parts of the body as in *chair, on, drink* and *friend* compared to the signs for *airplane, milk, hot* and *child* in which the hands do not touch other parts of the body.

5. The signs can be seen as they are made such as the signs for *milk, slow, stand* and *book* rather than the signs for *cow, rooster, stuck* and *horse* that cannot be seen by the signer.

6. One hand (unilateral) is involved in making signs such as *nose, bird* and *sorry,* rather than two handed bilateral signing such as *want, shoe, give,* and *big.*

Thus, the easiest signs to make are a) unilateral, toward the body, at the midline, with touch and vision, and with the forearm in a prone position (inside of the wrist faces down) or in a neutral position (inside of the wrist faces the body).

According to Dunn, the next most difficult signs to make, in order, are *bilateral signs* of the following nature.

1. One hand is held in place while the other hand performs an action as in *slow, clean, toast, car, jump* and *under.*

2. Both hands actively make opposite movements as in *steer, walk, come, go, bicycle* and *friend.*

Hand shapes also affect the difficulty of making signs. Dunn suggested that according to hand shape, the easiest signs to make, ordered from simple to difficult, are as listed below.

1. The whole hand works as a unit with no voluntary isolation of digits as in *yes, sorry, food, more, my, love* and *bicycle*, as well as in *O, S, A* and *5.*

2. The thumb is voluntarily isolated as in *B, C, 10, 4, glass, cake, car*, and *help.*

3. The index finger is isolated as in *I, thirsty, pain* and *sock.*

4. the thumb and index finger are isolated as in *L, long* and *green.*

Dunn's analysis indicated that more difficult hand shapes involve voluntary isolation of specific fingers as in the following examples.

1. Isolation of the index and middle fingers.

2. Isolation of the little finger.

3. Isolation of the thumb and little finger.

4. Isolation of the middle finger.

5. Isolation of thumb and middle finger (Dunn, 1982).

Dunn (1982) provides a worksheet for analyzing signs in terms of their a) movement in relationship to the body, b) hand usage patterns, c) hand shapes, and d) sign complexity. Also provided are guidelines for conducting an assessment of learner motor skills in relation to making signs. When student motoric strengths have been assessed, a) the dominant hand can be identified, b) signs can be chosen to fit learner motoric abilities, c) difficult signs can be avoided, d) sign-related exercises can be provided to overcome motoric weaknesses, and e) adaptations can be made for signs learners are physically unable to make. For communication with family and regular school friends, gross motor approximations of signs are generally acceptable, especially when vocabulary is limited and it is easy to discriminate one sign from another. In environments where larger numbers of signs are used and where

subtle discriminations among signs are necessary, more precise signing will likely be required. Visit the *Practical Sign Language Dictionary* at the address listed below.

http://www.handspeak.com

Sign Iconicity

Highly iconic signs may be easier to learn (Reichle, 1991) and are most useful when communicating with the general public who are more readily able to interpret their meaning. However, although translucency of a sign has been shown to influence the rate at which it is acquired, other factors are also important. The reinforcing value of an item might have a greater effect on the rate at which the corresponding gesture is acquired. For instance, a candy bar represented by an opaque gesture might be more readily acquired than a highly transparent gesture for water (Reichle, 1991). Another factor positively affecting sign or symbol acquisition is whether it represents a word already within an individual's receptive vocabulary. Nevertheless, when selecting gestures and signs, an important test is how readily the signs can be understood by the people with whom the learner will generally come in contact.

Using Signs

After signs have been selected, a sign dictionary should be compiled to promote consistency of use across communication partners in various environments. Signs relating to particular activities may be prominently displayed in areas where those activities are generally performed (Blischak, Loncke, Waller, 1997).

Whenever signs are used they should be augmented by pairing with speech, facial expressions, gestures and pantomime. Blischak, Loncke, & Waller (1997) suggest that most spoken words in a sentence should be represented by signs so that speech and signs mirror each other as two parallel channels. However, for learners having limited signing skills, teachers may speak entire phrases or sentences while only signing one or two words an individual has learned or is learning.

As mentioned earlier, sign selection should be based on an ecological inventory of the communicative demands placed upon individuals in the environments in which they characteristically interact. Alternatively, Fristoe and Lloyd (1980) developed a list of initial words/signs for persons with mental retardation, autism and severe communication impairments based on a) ease of signing, b) importance of the word/sign to the child, c) ability of others to guess the meaning of the sign from its visual characteristics, d) potential for the words/signs to be combined to convey meaning, e) functional communicative importance of each sign rather than enhancement of syntactic development, and f) the representation of various content categories such as, i) persons and animals; ii) object attributes, and iii) actions, etc. In addition, the authors selected 50 signs to reflect the size of the expressive vocabulary common to speaking children when they are about to begin production of two word phrases. The importance of a sign to a child was determined by a)

looking at what was important to all children at a particular level of cognitive development, and b) identifying objects and events commonly found in their environments.

Fristoe and Lloyd's list of initial, expressive signs may be useful in the absence of evidence from extensive ecological inventories of the language needs of a group of students. Particular signs may be added to or deleted from this list depending on objects and events commonly found in the environments of specific learners and the particular interests exhibited by those individuals. Nevertheless, preference should be given to vocabulary lists developed from ecological inventories of environments, task demands and functional routines commonly experienced by learners in their daily lives. The basic list of signs/words suggested by Fristoe and Lloyd is reported below.

An Initial, Expressive Sign Lexicon		
afraid	door	now
all gone; finished; used up	down	on
angry/ mad	drink**	open**
apple	eat; food**	pants*
baby**	fall	play
bad	father; daddy	put
ball	get	run
bathroom; toilet; potty	girl	sad
bed; sleep**	give*	school*
big	go	shirt
bird	good	shoe(s)
book	happy	sock
boy	hat	spoon
break; broken	have; possess	stand*
bring	heavy	stop
candy	help	table
car**	hot	T.V.
cat	house*	this; that; those
chair/sit	in*	throw
coat	kiss	under
comb*	look; watch	up
come	make	walk**
cookie	man	wash
cry**	milk	water
cup	more	woman
dirty	name sign (I, me, you)	you**
do	negative	
dog	no	

* 25% of the subjects tested correctly guessed the meaning of the sign from its visual characteristics; ** 50% correctly guessed the meaning of the sign

Gestures/Signs and Speech Production

Developing infants are known to integrate a number of modalities: gesture, body movements, facial expressions and vocalizations as means of communication prior to the development of speech as the primary linguistic mode (Capri, Iverson, Pizzuto & Volterra, 1996; Grove, 1997; Powell, 1999: Smith, 1997).

For many students having severe disabilities, speech is not the most effective method of communication. The decision to use an alternative or augmentative method of communication should not be viewed as abandoning eventual use of speech. Researchers have found that the use of augmentative and alternative communication does not inhibit speech production (Westling & Fox, 2000). Some evidence indicates that gestures combined with speech are more effective in establishing production than is either mode used alone (Barrera, Lobato-Barrera & Sulzer-Azaroff, 1980).

A number of studies have reported the positive effects of manual signing on early speech development (LeProvost, 1993; Remington & Clark, 1996) and later speech development (Layton & Savino, 1990). Longer positive effects of early sign intervention have also been reported for spoken vocabulary and social interaction skills including turn-taking and active conversation roles (Launonen, 1996, 1998). Miller, Leddy and Millo (1995) reported that early signing increased communicative success for children in the use of early words and in vocabulary growth although as intelligibility improved and the number of communication partners and vocabulary size increased, sign use declined (Powell, 1999).

Bondy and Frost (1994; 1998) reported that many of the children, 5 years of age and younger, who used the Picture Exchange Communication System PECS for more than one year developed speech. Siverman (1996) reported that contrary to the belief that such systems inhibit speech, there is accumulating evidence that they actually enhance the development or improvement of speech.

Powell (1999) reported that the use of manual signs continues, without doubt, to support early communication skills and lexical development for children and adults unable to express themselves verbally (Lanunonen, 1998: Miller, Leddy & Millo, 1995). Semantically children have been shown to produce modality-specific (manual) strategies to add to the meaning; however, syntactic abilities tend to remain restricted with the majority reaching a plateau at an early stage of development (Grove, Dockerell & Woll, 1996).

To develop and improve communication, it is essential that communication partners be responsive to the learner's attempts to communicate, build on existing communication skills, give the learner control over the environment, and use conversational responses as natural reinforcers. Unfortunately, however, in a study by Grove, Dockerell & Woll (1996), the number of manual signs per spoken utterance produced by teachers was rarely above 2.0. In addition, individuals relying on manual signs and graphic symbols were frequently only exposed to their use in planned routines and limited situations (Powell, 1999).

Aided Methods of Augmentative/ Alternative Communication (AAC)

Aided methods of augmentative and alternative communication require some form of equipment such as the use of objects, photographs, pictures, drawings, pictographs, graphic representations of signs, Braille and synthetic speech.

Object Communication

Object communication involves the use of life-size (e.g., tea cup) or miniature representations (e.g., miniature doll-size cup) of familiar objects. Real objects have been successfully used for communication by individuals having severe disabilities and/or visual impairments (Westling & Fox, 2000). For example, a child may bring his coat to his teacher to communicate, "I want to go out." A child may also bring a cup to her mother to indicate, "I want a drink." Objects are most useful for learners who do not demonstrate the ability to match pictures to the actual items, events or people represented. Note that according to Goetz and Hunt (1994), some learners find miniature objects to be significantly more abstract than are real objects.

Textured symbols. Textured symbols may be considered a form of object communication. Textured materials may include actual parts of their referents such as a strip of leather from a leash representing *taking the dog for a walk*, or a piece of smooth metal symbolizing *a ride on the playground slide*. More abstract symbols may also be used. For example an individual may be taught to associate a piece of fur with the action *feed the dog*. Textured communication may be an alternative for learners with visual disabilities or who are deafblind and who cannot match pictures to actual items, events or people represented. Although no related information was found in the research literature, it may also be possible that some children having autism and a fascination with texture may be able to make texture-object/action associations as a method of communication.

Representational Graphic Symbols Communication

Black and White or Color Photographs. Photographs represent actual objects, activities, locations, and people. *Imaginart* sells sets of photographs at their Web site listed below. Some data suggests for individuals with severe intellectual disabilities, photos may be easier to interpret than are black and white line-drawings; however, caution must be taken in assuming this is true for all students with severe disabilities. One must consider each individual's cognitive abilities, visual processing skills, prior knowledge and experience (Goetz & Hunt, 1994).

http://www.imaginartonline.com/

Simple, Black and White Line-drawings. Some students, according to Goetz and Hunt (1994), find it easier to interpret line-drawings that are less complex in configuration than are photographs that may present distracting elements and variations in

both shape and color.

Picture Communication Symbols (PCS) (Johnson, 1994). PCS are the most commonly used sets of symbols (Downing, 1999). PCS provides simple line-drawings organized into categories such as social, people, verbs, descriptive, nouns, food, leisure. For example: *book* is represented by a drawing of a book; *help* shows a child kneeling in front of another child with extended arms; *slow* is depicted by a picture of a turtle; *OK!* is represented by a hand with the thumb and forefinger tips pressed together to form an *O*. PCS symbols and *Boardmaker* Software are available from Mayer-Johnson, Inc. at the address listed below. *Boardmaker* is a graphics database with over 3000 PCS symbols that can be used to create various communication boards in color or black and white. Each PCS symbol in color or black and white is translated into 10 international languages. Examples of PCS symbols are depicted in Figure 4.

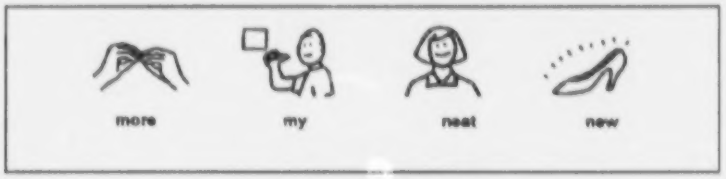

Figure 4. PCS Symbols

http://www.mayerjohnson.com/software/Boardmkr.html

Pictographic Ideogram Communication (PIC). PIC uses pictographs and ideographs. Pictographs are picture/symbols that look like the objects they represent. Ideographs are symbols that represent *ideas*, actions and feelings. The PIC approach is different from other similar systems in that PIC uses 400 white symbols on a black background to increase visibility.

Picsyms. Picsyms is a system of more than 1,800 black line-drawings, pictographic or abstract, each of which is accompanied by text labels. The shape or manner of representation of a symbol provides a clue to the semantic category the items belong to. For example, action is represented by an arrow indicating the direction of the action. Many of the symbols are visually complex. *Picsyms Categorical Dictionary* (1988) is written by Faith Carlson and published by Baggeboda Press, Lawrence, KS. The dictionary is also available from Don Johnston Developmental Equipment, POB. 639, 1000 N. Rand Road, Wauconda, IL 60084.

http://www.donjohnston.com

Rebus. The rebus symbols developed from the *Peabody Reading Scheme* represent objects, actions and attribute words in the form of stylized pictures. Various Rebus symbols are ideographic, abstract or based on *homonyms* (e.g., *be* is represented by a picture of a *bee*); some symbols incorporate phonetic elements (e.g., *heat* is represented by the symbol *h* followed by a stick-figure head putting food *eat* into its mouth) (Jones & Cregan, 1986). See *Writing with Symbols*, a software program containing over 5000 Rebus symbols including *Symbols to Sentences* and *Grid Maker* at Spectronics. *The Standard Rebus Glossary* is available from American Guidance Services, Circle Pines, MN 55014. The glossary contains over 800 black and white rebuses representing over 2000 words. Because Rebus depends upon homonyms, it is best suited to people with normal hearing and a good receptive vocabulary. Additional information is available from the address listed below.

http://www.spectronicsinoz.com/spectronics/product.asp?product

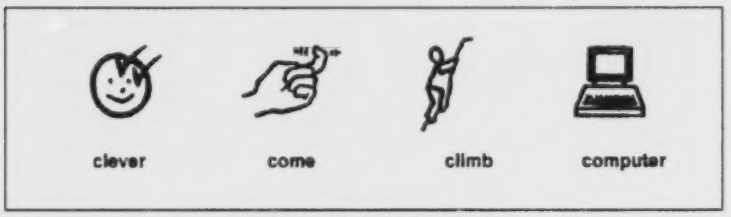

Figure 5. Rebus Symbols

Sigsymbols. The name *sigsymbols* is derived from the combination of signs and symbols. The approach uses pictographs, ideographs and 190 manual signs. When pictographs and ideographs cannot be used to represent an abstract idea, pictures of manual signs taken from sign language are used. Cregan and Lloyd (1990) have published a dictionary of sigsymbols. Sigsymbols would be most useful for someone who already has a well developed receptive sign vocabulary. The illustration below shows one type of application of sigsymbols (Jones & Cregan1986).

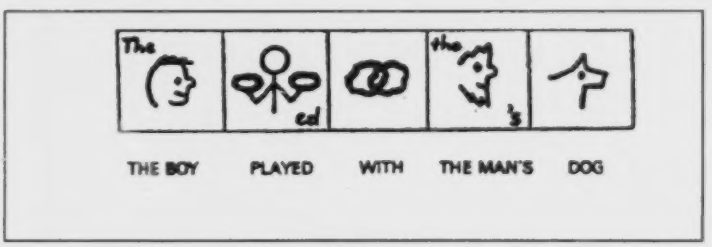

Figure 6. Sigsymbols

Blissymbols. Blissymbolics uses pictographs, ideographs and arbitrary symbols. The approach uses rather abstract representations, typically less readily understood than are pictographic symbols. Blissymbols uses nine basic shapes to represent 2,500 vocabulary items; the size, orientation and position of these shapes determines their meaning. For example, putting together the symbols for *person*, *mouth* and *musical note* represents *singer* (Westling & Fox, 2000). There are symbols for all parts of speech. Because Blissymbols are not readily understood by the uninitiated, each symbol is accompanied a printed word representing its meaning. Blissymbols are particularly suitable for cognitively intact individuals having cerebral palsy. *AccessBliss* contains all the approved Blissymbols; users can select and copy symbols to a clipboard for word processing or drawing programs. Examples of Blissymbols are shown below. Information: *Blissymbolics Communication International*, 1630 Lawrence Ave. West, Suite 104. Toronto Ontario, Canada. M6L Tel: (416) 242-9114, Fax: (416) 244-6543.

http://home.istar.ca/~bci/contact.htm

Bliss Processor is an electronic keyboard on which a user and a communication partner select Blissymbols either directly or through switches to be displayed on a computer screen, printed or spoken in various languages. Contact Blissymbolics Communication International at the above address.

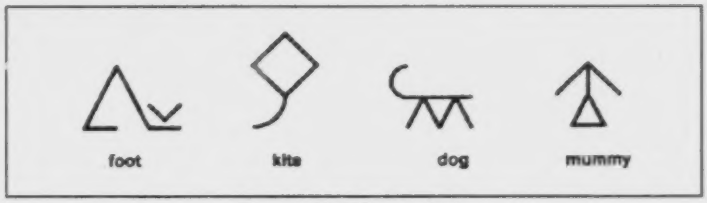

Figure 7. Blissymbols

PECS (Picture Exchange Communication System). This approach is not a set of specific symbols but a teaching strategy developed in 1987 by Bondy and Frost (1994; 1998) for teaching communication to children having autism. The approach has been used with a variety of children (as young as 2 years of age) and adults, who either did not use speech or who spoke with limited effectiveness. The method involves using prompting, fading and shaping techniques as well as discrete trial, sequential formats and incidental training to teach learners to *initiate* communication by giving symbols to communication partners. PECS uses communication books in which communication symbols/pictures have been stuck with velcro onto strips. The symbols are removed from the strips and given individually or in combination on velcro sentence strips to communication partners. The first stage in teaching the PECS approach to a particular learner is to identify some highly reinforcing activity or object the learner wants. The learner is then prompted to give the corresponding symbol to the communication partner to *request* the activity/object. Upon receipt of the symbol, the communication partner reinforces the learner by giving him or her

the requested item or activity. Subsequent stages of learning involve teaching the learner to discriminate among symbols; various methods of discrimination training are employed depending on the learner. Learners are taught to form sentences using a sentence strip to make *comments* as well as *requests*. The authors report that many of the children, 5 years of age and younger, who used PECS for more than one year developed speech. Siverman (1996) reports that contrary to the belief that such systems inhibit speech, there is accumulating evidence that they actually enhance the development or improvement of speech. Although PECS was designed as a very structured method of teaching - certification in the technique is available - the technique has come to mean different things to different practitioners. Some users consider PECS to be simply a method of exchanging picture/symbols during communication. Thus, care should be taken when interpreting statements made about the effectiveness of PECS to ascertain what specific techniques were employed. As mentioned, PECS, as designed by Bondy and Frost, is a highly structured curriculum.

Logos. Logos include product labels or pictures such as one might find on bags of junk food, or the Coke symbol or the logo design found on a box of Kellogg's cereal.

Makaton Vocabulary. Although a multi-modal approach to communication rather than simply a pictographic method, Makaton is included in the present discussion because it does include the use of graphic symbols. Makaton is a *total communication* or *multi-modal approach* for teaching communication, language and literacy skills through a combination of manual signs, symbols and speech. Makaton stresses that whichever system of communication is being used, signs and/or symbols, it must be accompanied by speech. The *Core Vocabulary* is comprised of 450 language concepts essential to everyday life. A *Resource Vocabulary* covering broader life experiences includes over 7000 concepts. The Makaton Vocabulary has been divided into eight stages corresponding to normal language development. The stages, taught in order, make up a language program. Makaton symbols and signs (revised in 1996) are matched to all the concepts in the Core and Resource Vocabularies to be used with speech, the written word or alone. In the U.K. where Makaton was developed, signs have been adopted from the British Sign Language, but in other countries where Makaton is used, 40 countries worldwide, signs are adopted from the sign language used by the deaf in each particular country. The original line-drawing symbols used in Makaton were adopted from the Peabody, Rebus Program. Symbols have been adopted and developed that are pictographic and easily drawn by hand. The illustration below, taken from Corker and Rice (1996) demonstrates two of several methods in which the Makaton may be used. The Revised Makaton Vocabulary has reportedly been successfully used with the following types of learners:

a. children and adults having mental handicaps and deafness;

b. children and adults who are not deaf but who have little or no expressive speech and poor comprehension;

c. children and adults having physical and mild to moderate mental

disabilities;

d. children having autism;

e. deaf children who are intellectually normal;

f. children having severe articulation problems, e.g. articulatory dyspraxia ,as a temporary alternative method of communication; and

g. adults having communication difficulties arising from strokes.

Additional information may be obtained from Margaret Walker, Makaton Vocabulary Development Project, 31 Firwood Drive, Camberley, GU15 3QD, England. Examples of the Makaton Vocabulary are illustrated below.

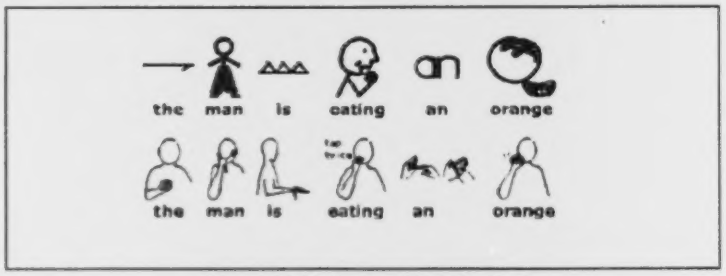

Figure 8. Makaton Vocabulary

http://www.makaton.org

Selecting Symbol Types

1. Guidelines for selecting an augmentative and alternative system may be found at the following address.

http://snow.utoronto.ca/shared/ccps/newpage3.htm

2. The types of symbols used should make sense to the user and communication partners the individual is likely to interact with in current and future environments. These communication partners may include peers, teachers, family, friends and strangers having varying degrees of familiarity and skill related to receptive and expressive symbol communication. Since communication is a two-way process, wherever possible, consideration must

be given to adopting the same methods of communication used by likely communication partners, with the result that one method of communication may be used to both send and receive messages.

3. If a student is just learning to use symbols, the similarity between the symbol and the referent (iconicity) should be as obvious as possible. According to research, iconic symbols that closely resemble the items they represent tend to be easier to learn and are more consistently maintained and generalized than are more abstract or arbitrary symbols (e.g., Blissymbols). It has also been shown that the relationship between a symbol and the corresponding spoken word is more readily established with iconic symbols. Alternatively, for learners functioning at higher cognitive levels, Blissymbols offer the advantage that they can be combined in sentence-like forms replicating the ways in which grammatical speech can be used to create novel utterances. Moreover, the use of printed words that usually accompany abstract symbols has the advantage of being immediately recognizable by most people in the community (Mustonen, Locke, Reichle, Solbrack & Lindgren, 1991).

4. Symbol sizes, colors and spacing between symbols should be determined by the learner's visual skills.

5. The symbols used do not all have to be of the same type. Students will generally benefit most from communication displays having symbols mixed and matched on an individually preferred basis (e.g., an individual may use a combination of colored photographs, printed words, and line-drawings to represent various messages, communication partners and tasks) (Downing, 1999). Refer to a later section of this manuscript, *Using Multiple Forms of Communication.*

6. Refer also to the earlier section of this manuscript, *Sign and Symbol Vocabulary Selection.*

Communication Devices

Information Sources

A list of suppliers, manufacturers and organizations related to augmentative and alternative methods of communication can be found in Appendix A. Refer also to *Closing the Gap* at the address listed below, an excellent source of information related to computer technology in special education and rehabilitation. *Closing the Gap*, a bi-monthy publication, describes new products; the annual *Resource Directory* is a guide to the selection of the latest computer products available for people with special needs.

http://www.closingthegap.com

A broad variety of useful information relating to selection, design and use of augmentative and alternative communication is available from *ACE Centre-North* (Aiding Communication in Education), Broadbent Road, Watersheddings, Oldham, England OL1 4HU.

http://www.ace-north.org.uk/index.htm

Of particular usefulness at the ACE site is the *AAC System Picker* listed below, a branching, decision-making program designed to assist selection of a suitable low or high tech, augmentative/alternative communication system.

http://www.ace-north.org.uk/aacdecision.htm

Also available at the following address is an excellent list of *Important factors influencing the choice of an AAC system.*

http://www.ace-north.org.uk/aacissues.htm

Low Tech Communication Devices

(Low Tech devices do not require electronic equipment.)

Note: the communication devices listed below are illustrative and do not constitute a complete listing nor a recommendation of any specific device. Names and addresses of developers and suppliers of communication devices and programs can be found in Appendix A.

Tangible Symbols. Tangible symbols include actual objects, miniature objects or parts of objects that can be seen and/or touched. For example, a ball may signal it is time for gym; a miniature cup may indicate snack time, while a piece of vinyl (like the seats on the bus) communicates that it's time to get on the bus. Tangible objects may be particularly useful for individuals having visual disabilities or for learners who are unable to use more abstract symbols.

Pictures. Pictures may include black and white, or color photographs, pictures cut from magazines or pictures downloaded from the Net. Polaroid pictures may be taken of actual objects, people and events in an individual's environment. Polaroid cameras provide a quick method of producing pictures from a learner's actual environment. In some cases, it may be advantageous to take pictures of objects and people against plain, non-distracting backgrounds. Electronic cameras provide a quick method for taking pictures and putting

them into computers where the quality can be improved - irrelevant details may be removed while discriminating details are highlighted. In this manner, a series of pictures may be quickly prepared in which the highlighting is progressively faded while the distracting detail that had been initially removed is reintroduced.

Photo Boards. Photo boards are communication boards on which photos have been mounted. The user can communicate by pointing by hand, head-pointer or other device to particular pictures. Alternatively, if the user is unable to point, a communication partner can point in sequence to the pictures, asking "Do you want (name of item pointed to)?" Communication is complete when the user makes a pre-arranged response such as an eye blink or head nod to confirm that the communication partner has pointed to the desired item.

Schedule or Calendar Boxes. A calendar is represented by a row of boxes in which a symbol, object or part of an object has been placed in each box to represent a sequence of activities. The pictures or symbols may also be organized in a matrix of boxes forming rows and columns, representing a schedule of activities at various times (rows) over several days (columns).

Communication Books. Communication books may be constructed in various ways. For example, photo albums or 3-ring binders may be used with pictures and/or symbols mounted on each page. Different categories of pictures may be mounted on separate pages and/or in different sections, indicated by uniquely colored pages. For instance, Mayer-Johnson describes a 5 1/8" x 6 3/4" 12 page book holding 576 symbols that can fit within a large pocket or purse. Mayer-Johnson can be accessed at the following address.

http://www.mayer-johnson.com/products/main.html

Communication Vests. Teachers and/or students may wear lightweight vests to which velcro backed symbols have be affixed to accommodate the communication needs of a particular child and/or activity. See Mayer-Johnson for examples.

Communication Charts. These charts of pictures and/or symbols may be mounted in various activity areas depicting common vocabulary used in each area (e.g., cooking, recreation lounge or woodwork shop). The charts can be used by staff and students within the specific activity area.

For example, a communication board mounted in a cooking area may include pictures and/or symbols of a) hand tools and equipment: *pots, spatula, mixing spoon, cutting board, hot pad, measuring cups, mixing bowls*...; b) appliances: *stove, fridge, blender* ...; c) ingredients: *flour, sugar, butter, salt* ...; d) action words: *cut, mix, wash, boil, turn* ...; e) descriptive words: *smooth, hot, cold* ...; f) maintenance equipment: *dishwasher soap, cleanser, wash rag* ...; and g) communication symbols: *yes, no, help, want, thank you, I* .... (adapted from Cafiero, 1998).

Communication Cards. Laminated symbols or picture cards can be mounted on key rings. To assist rapid selection, pictures referring to one type of activity may mounted on cards of one color, while cards of other colors can be used for different types of activities.

E-TRAN (Eye TRANsfer) Frames. An E-Tran frame is a clear plexiglass frame with a large cut-out rectangle in the middle. The frame is mounted vertically between a *user* and a communication partner. Mounted on the perimeter of the frame are letters, words, pictures and/or symbols. Each item is visible from both sides of the frame. The user communicates by gazing at a particular word, picture or symbol. The communication partner, looking through the hole in the middle of the frame, is able to observe where the user is gazing. The communication partner can confirm understanding of the message by pointing to the item he or she thinks the user has indicated.

Communication Wallets. Mayer-Johnson sells a *long wallet*, 4 x 8 ½", that has 12 pages with 576 symbols. The wallet fits into a back pocket or purse. A smaller wallet of 4 x 5 3/4" has 12 pages and holds 288 symbols. Photo holders for regular wallets are also generally available in a variety of retail stores.

Folding Communication Boards. Mayer-Johnson also describes a folding communication board or folder holding four 81/2 x 11" grids displaying 320 symbols.

Conversation Displays. Conversation displays are small, portable albums displaying a variety of photographs, magazine pictures and other items of interest to a particular individual wishing to use the display as of means of engaging other people in conversations. For example the display may include photographs of rock stars or one's pet, hockey cards, political buttons, and pictures with captions such as "I like the Rams." The conversation display may be exposed to potential conversation partners to stimulate discussion about one's interests (Downing, 1999).

Medium Tech Communication Devices

(These devices have some elementary electrical components such as batteries and switches.)

Pointer Boards. Pointer boards, displaying pictures, symbols or words, have a switch operated pointer that rotates to point in sequence to each of the individual communication items displayed. The user can manipulate a switch to start the pointer scanning and to stop it when it points to the specific message he or she wants to communicate.

Switch Activated Voice Recordings. Switches can be connected to simple devices like cassette recorders or single message, tape-loop devices on which voice messages have been prerecorded. Messages recorded for classroom use may include, "I need help please" or "Please take me to the washroom." For someone taking a public bus, the message may say, "Please show me how to get to Broadway and Main."

BIGmack is an example of one of these devices. *BIGmack* is a pocket size device that when activated, plays a single message up to 20 seconds long; new messages can be recorded in seconds, with different messages being recorded for different situations (AbleNet, Inc). *Talk Back*, a similar device records six messages (Crestwood Co.) while *Parrot* records 16 messages (Zygo Industries).

http://www.ablenet.com/

The Home Message Digital Recorder available from RadioShack has four mailboxes, each having 60 seconds of multiple-message recording time. Each of the four mailboxes may be used to record messages for a different person or for different types of messages relevant to a single individual performing in four different situations. The device sells for under $50.00.

Two *Recording Photo Albums*, also available from RadioShack, have 20 pages each, with 90 second or 190 second recording chips permitting voice comments to be recorded for each page. Both items are available for under $60.00. A *Talking Picture Frame* is also available. This device displays a picture and a 20 second recorded message of one's choice. The messages and pictures can be changed as desired. Cost: less than $25.00.

High Tech Communication Devices

(High Tech devices employ high technology electronics.)

Sources of Information. Electronic communication devices are reviewed at several sites including the addresses listed below. Quist and Lloyd (1997) provide a comprehensive and detailed introduction to high technology augmentative and alternative communication equipment. The devices listed below provide examples, not necessarily recommendations, of some of the many devices available. New devices are constantly being developed and potential users should consult the developers and suppliers, listed in *Appendix A*, to determine what is available. *Closing the Gap* lists over 2000 products related to computer technology in special education and rehabilitation - an excellent source of information.

http://www.closingthegap.com

http://polio.dyndns.org/chip/seleccom.htm

Clock Communicators: Scanning Communication Aids

A clock communicator get its name from a rotating selection arm, like the big hand on a clock, moving around a circle of symbols arranged like the numbers on a clock face. Some clock communicators permit variable speed.

Comboard. This device is a battery operated, square board on which pictures and symbols are mounted around the perimeter. A motor driven pointer is mounted in the middle

of the board. The pointer is operated by two switches, one moving the pointer clockwise, the other moving it counter-clockwise. Toggling the switches stops the pointer at the desired picture or symbol. Available from TASH Inc. at the address below.

http://www.tashinc.com/

Dial Scan. *Dial Scan* is a switch operated, rotary, scanning device. A dial mounted on the middle of a clear screen rotates to point to individual pictures or words. The dial stops moving when the switch is released. The see-through screen encourages interactive communication. Available from Don Johnston Development Equipment at the following address.

http://www.donjohnston.com

Electronic Scanning Communication Devices

Zygo Model 16C. On this device, characters and words are displayed in rows on a screen on which a selector box moves automatically from row to row; the user activates a switch when the character or word is within the selector box. Available from Zygo Industries at the following address.

http://www.zygo-usa.com/

ScanPAC. *ScanPAC* is a portable, battery powered communication aid that can be used in conjunction with *RealVoice* (described below). The device provides text to speech capability permitting messages, typed or selected, to be spoken or printed. It is also possible to assign voice output to single picture selection or picture sequencing of up to 5 symbols. Available from Adaptive Communication Systems.

Electronic Keyboard Operated Communication Devices

Canon Communicator. This is a portable communication aid that offers printed tape output and voice input/output; selected keys store words or phrases of up to 19 characters; scanning is also possible. Available from Canon at the following address.

Real Voice. *Real Voice* is a portable communication aid converting typed messages into synthesized speech with natural sounding rhythm and intonation in either a male or female voice. Available from Alton Technical Services.

Talker 11. This is a portable, speech output, communication aid having an 80

character display. The text-to-speech mode pronounces any entry. The device provides single keystroke operation with up to 40 programmable pages. Available from Intex Micro Systems.

Voice Output Communication Systems

MessageMate. This is a palm-size screen displaying words, pictures or symbols that, when touched, speaks in a male or female voice. Messages can be prerecorded in any language. Users can combine symbols, words or phrases into a single message. Available from Words+, Inc. at the following address.

http://www.words-plus.com

Talking Screen. The *Talking Screen* is a communication board on a computer screen displaying 1-32 symbols, letters, words or sentences per page. When selected by touch or a switch, the items are verbalized through a speech synthesizer and/or digitized tape. The device can also be used to operate word processing programs and environmental control units. Available from Words+, Inc.

AlphaTalker. The *AlphaTalker* is a voice output communication aid displaying pictures or symbols that when selected play between 100 and 200 words and phrases of highly intelligible, prerecorded messages. The device can be accessed by hand- or head-operated light-pointers. Alternatively, using a scanner, lights appear on the display keyboard that can be sensed by a device worn by a user. *AlphaTalker* can also perform computer functions and can be reconfigured to provide large or small displays of symbols and pictures, each having a large or small display area to accommodate activation by a user's fingers, fist or palm. *AlphaTalker* replaces the *IntroTalker* and is available from Prentke Romich Communications at the address that follows.

http://www.prentrom.com

Photodetection Devices

VisionKey. This communication device uses a photodetector that tracks eye movement from infrared light reflected from the eyes. The device uses a head mounted viewer and is useful for someone with sight but impaired motor/verbal ability. Using an LCD display, VisionKey permits one-to-one communication. The device uses direct selection or scanning and offers full computer control. By directing one's eyes, the user types characters or commands. H.K. Eyecan, Ltd. info@eyecan.ca 36 Burland Street, Ottawa, ON K2B 6J8.

Print to Speech Devices

Kurzweil Personal Reader. The reader is a transportable reading system that converts text to speech. The device is designed for individuals who either have a visual

impairment and/or have difficulty reading printed material. Available from Xerox Imaging Systems, Inc.

Print to Braille

Duxbury Braille Translation Software: converts regular print to Braille and vice versa; permits highly accurate production Braille for school books and teaching materials; provides word processing in Braille and print.

Vibrotactile Communication Devices

Vibrotactile hearing aids are generally of two types: those attached to one's body, wrist, sternum, clavicle or arm, and hand-held devices. These aids can be used with individuals having severe and profound deafness to teach speech production and improve speech recognition when used in conjunction with lip reading. Vibrotactile aids may be of use to pre- and post-lingually deaf children, who receive little, if any benefit, from hearing aids. Improvements derived from the use of vibrotactile aids vary depending upon a number of factors affecting individual users.

Tactaid 2000. This is a six channel instrument designed to permit differentiation of high frequency sounds. Five vibrators permit detection and discrimination of sounds in the speech spectrum from 2000 to 8000 Hz. Tactaid receives sound via a built-in microphone, processes the sound electronically and sends information about the rhythm, duration and intensity of the sound to vibrators that vibrate against a user's skin. The device can be used alone or in conjunction with a hearing aid or cochlear implants. The Tactaid increases general awareness of environmental sounds, voice and music. The device is reported to be of particular assistance to children having some low frequency hearing (Audiological Engineering Corp.).

http://www.tactaid.com/

LTD(Little Tactile Device). This aid replaces Tactaid II. The LTD is a pocket-size device having two vibrators, respectively for high and low frequency sounds, presenting both spectral and temporal information (Audiological Engineering Corp.).

OSCAR (Optimal Speech Communication Assistance for Residual Hearing). The hand-held OSCAR speech processor uses digital signal processing interfacing with both acoustic and multiple tactile transducers. OSCAR is about the size of a flashlight and is held close to the mouth of a speaker. The hand and thumb gripping OSCAR are each stimulated by one of two transducers. The syllabic, rhythm and fricative information of speech are transmitted to the hands. The information is presented auditorially and/or tactiley. The device is designed for a wide range of individuals having severe, profound and total hearing losses. According to Spens, Agelfors & Lignell (1998), the device gives optimum tactile support to lip readers who are adventitiously deaf and have a rather good knowledge of the

language structure. The device is recommended for use when speech communication is necessary and other methods of communication such as sign language, lip reading, reading and writing are of negligible value (Dr. Andrew Faulkner, Department of Phonetics and Linguistics, University College of London, 4 Wolfson House, London, NE1 2HE).

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Tactilator. The tactilator is a two-channel tactile aid having high and low frequency vibrators. The low frequency vibrator transmits both spectral and voicing cues, while the high frequency vibrator reports temporal information. The primary purpose of the Tactilator is to enhance speechreading (Audiological Engineering Corp.).

http://www.tactaid.com/

Using Multiple Forms of Communication

Usually a single alternative or augmentative communication method will not meet all an individual's communication needs. Most individuals use a combination of both aided and unaided techniques to communicate with different people in various situations.

For example, an individual may place an order for food in a restaurant in the following ways: a) present a pre-printed list of food items, b) point to pictured or printed items on the menu, c) point to pictured items in the student's own picture communication book, d) point to actual food items, e) place a *standard order* of hamburger, chips and a Coke, e) use a speech synthesizer to 'verbally order' items, or f) use a Braille menu on which pictured items are displayed that the server can see.

A *mixed mode approach* may be used in various combinations to fulfill different communicative demands and may be used *concurrently* as a form of *total communication* in which, for example, speech and signs provide redundant cues to the receiver when one of the modes may not be intelligible. Orelove and Sobsey (1996) state that a mixed mode approach to teaching communication skills is the best alternative for learners with severe disabilities. For example, "if a child can vocalize three distinct words, form four signs, point to five pictures and communicate two concepts through touch, the child can communicate 14 items by mixing modes (p.261)."

Thus, rather than focus on one exclusive form of communication, such as pointing to pictures, learners should be taught a variety of methods that may be used singularly or in combination in different contexts. Pointing to pictures is often a poor method for gaining attention; however, when combined with verbal (shouting) and gestural (arm waving), picture pointing may be an effective way to draw attention to a specific concern represented by a picture (e.g., the need to use a toilet).

Other considerations related to the selection of various communication methods are listed below.

1. Using a sign language as the primary mode of communication is limited by the number of people who may not understand the signs. However, sign language may be appropriate when speech and other forms of communication are ruled out or when communication usually occurs in environments where signs are commonly used. Natural gestures, generally understood by most observers, have several advantages: a) they are commonly understood; b) because they are commonly used in natural contexts by other people, there are many incidental models; c) gestures may already be part of an individual's repertoire and d) gestures usually involve gross- rather than more difficult fine-motor movements (Orelove & Sobsey, 1996).

2. Graphic systems include: a) actual objects, b) pictures that may be colored, or black and white photographs; or realistic, colored drawings; or line-drawings, c) icons in which the image and the actual object share identical features, or d) abstract symbols. Abstract systems may be more difficult to learn than are iconic systems and may be understood by fewer observers. Orelove and Sobsey (1996) report that black and white line-drawings may be simpler to discriminate than are more complex, colored photographs. However, some line-drawings may not provide a good representation of referent objects, while photographs of objects against a plain background may be more easily matched with their referents.

3. Orelove and Sobsey (1996) state that although advances in electronic technology have made electronic methods of communication a good alternative for increasing numbers of individuals with severe disabilities, low technology alternatives are still more appropriate for many and perhaps most individuals with severe disabilities. Simple communication boards using photographs, pictures cut from catalogues or other graphic symbols, typically cost less, can be easily individualized, are more durable and easily repaired, and frequently are equally useful in communication.

4. Select forms of communication based on assessment of: a) the individual's abilities; b) the communicative abilities of people with whom the individual is likely to interact; c) the demands of the social and physical contexts within which the individual is likely to perform now and in future, and d) the functional demands the individual is likely to make upon the people in the environment. The methods of communication taught must be functional for the individual.

5. Select effective forms of communication that will be understood by the greatest number of people in the various contexts, residential, school,

community, vocational and recreational, in which the individual is likely to perform.

6. The more normalized the form of communication used, the broader the audience of understanding. Idiosyncratic or symbolic forms of communication may be understood by few people. For example, Blissymbols are an effective form of communication only among people fully familiar with the meaning of the symbols.

7. Choose methods of communication that have broad social acceptability. For example, although a high pitched scream and a gesture may be a highly effective means of communicating a particular message, that form of communication may be generally unacceptable and objectionable (Neel & Billingsley, 1989).

8. Initially build fluency rather than quality of communication, as increasing fluency will provide increasing opportunities for refinement.

The following checklist describes some of the considerations that should be made in the selection of a communication *system* of various symbols, techniques and devices that might be used by a single individual. When considering each category in the checklist, it may be advantageous to cross out items that are not relevant to a particular individual and to use a highlighting pen to emphasis problem areas.

AAC Multi-Component Communication System Requirements. Adapted from Lloyd, Fuller and Arvidson, 1997.		
Provides full range of communicative functions: communication of basic needs; meets conversational demands of attention-getting, turn-taking, interrupting, resisting interruption, conversation repairing; writing and messaging; computer access: electronic communication; computer aided-learning and information systems?	**Meets needs? Yes**	**No**
Compatible with other aspects of the individual's life: physical positions: seated, lying down, standing, wheelchair; mobility; portability; permits environmental controls; accommodates other devices and teaching approaches common to the environment?		
Does not restrict communication partners: messages are readily conveyed to strangers 3-5 feet away; usable with people not familiar with the special techniques or symbols; display may be permanent, temporary static or dynamic, displayed and/or printed to assist communication; promotes face-to-face communication; usable with groups; functional in the general community; permits private discussion if desired; similar to communication systems used by peers?		
Does not restrict topic or scope of communication: any topic, word or idea can be expressed; assists sharing of feelings and emotions; has user-defined vocabulary; suits variety of activities and tasks in which the individual is likely to be involved?		
Effective: has sufficiently rapid rate to meet typical communication demands; enables rapid environmental control; permits rapid and effective communication for emergencies; facilitates communication of basic needs over a usable distance; low fatigue?		
Permits and fosters growth: appropriate for individual's current physical, cognitive and sensory skills; allows growth in vocabulary, topic, grammar and uses; new vocabulary and other added aspects may be relatively quickly learned?		
Acceptable and motivating to user and communication partners: user; family; peers; educational, recreational and employment personnel/partners?		
Affordable: initial purchase; maintenance; training of assistants, aides; materials; amount of training required of user, clinician and others is acceptable?		
Durability: usable and not likely to be readily damaged in the variety of activities in which individual is/will be involved; does not require frequent repair or calibration; does not frequently malfunction?		
Esthetics: acceptable appearance; not stigmatizing form of communication?		

Enabling Switches

Enabling switches are used for a variety of purposes, for example, to operate scanners that search for the correct symbol or word on a communication device; to activate and direct environmental control devices answering telephones and turning on/off lights, radios, television and other appliances, as well as activating motor driven toys. *Enabling Devices, a Division of Toys for Special Children* describes, illustrates and sells a large number of ability switches and other products at the following address. Some of these devices are described below.

Figure 9. Switch

http://www.enablingdevices.com

Each of the following types of enabling switch requires specialized skills to operate.

Head Switches. Head switches, sometimes shaped like a small pillow, are located on either one or both sides of an individual's head. Slight movement of one's head results in pressure on one of the pillows thereby activating a corresponding switch.

Leaf Switches. Leaf switches are upright, flexible strips, like a thin reed often 1" wide and 6" long; they are activated when moved to either the right or left.

Mercury Switches. These switches may be attached to a limb, head or torso. Movement of that part of the body results in movement of mercury in a tube to either make or break an electric current and thereby switch an attached device on or off.

String Switches. String switches involve tying a string to a part of the body, which when moved slightly, pulls the string to activate a switch.

Button switches. These switches require pressure on a button. The button may be quite large, lighted, and brightly colored, activated by a gentle press or glancing blow, or the button may be rather small and imbedded, requiring a more refined digital movement for activation. These switches may initiate continuous activity or they may have to be re-activated after a predetermined interval (e.g., 15 seconds) to maintain activity.

Joystick. Joysticks are upright dowel-like rods that may be activated by a *push* in any direction. Joysticks are often grasped and controlled by fist movements. Usually the direction of the push or pull determines the nature of the resulting effect. For example, a diagonal push up to the right may move a computer cursor or a motor driven wheelchair in the corresponding direction, while a downward pull to the right would result in a movement of the cursor or wheelchair in the opposite direction.

Figure 10. Joystick

Push Switches. These switches include joysticks, push buttons, push plates, and pressure switches requiring continuous pressure to activate; release of pressure deactivates. Switches of this nature can be activated by any part of the body and vary in sensitivity.

Sip/Puff Switches. Sip/puff switches are usually flexible tubes with a mouthpiece at one end. The switches are placed close to or in an individual's mouth. The person can activate the switch by either blowing air into or sipping air out of the switch.

Air Pressure Switches. These switches include sip/puff switches as well as pneumatic, bulb, air cushion or squeeze switches. One type of air pressure switch is operated by grasping and squeezing a bulb.

Single Muscle Sensors (P-switch). With these switches, a small disk is attached to a part of the body and connected by wire to a small control box. The disk detects very small amounts of muscle movement depending on setting or sensitivity level. The signal transmitted to the control box activates a switch.

At the address below, *Trace* lists a number of companies that make switches and controls. Some of the devices described are: light-activated switches; animated switch controllers; communication devices and environmental controls; adapted toys; switches for computer access; breath switches; switches related to head support; infrared-sound-touch switches and lever switches.

http://trace.wisc.edu/docs/quick_sheets/qs30html

York, Nietupski and Hamre-Nietupski (1985) describe several considerations that should be made when choosing enabling switches:

a. determine the strength and accuracy of the motor movement required (e.g., determine how large the response area of the switch must be and how sensitive the switch is to touch, movement, sound, and/or breath);

b. assess if the learner is able to sustain contact with the switch (some types of switches require more than fleeting contact for activation);

c. determine if the learner requires some type of sensory feedback to indicate the switch has been activated. Some switches provide auditory, tactile, kinesthetic, or visual feedback to signal activation., and

d. assess special mounting requirements.

Mileau Methods for Teaching Communication

The procedures discussed below illustrate a) effective teaching methods that take place during naturally occurring daily activities (naturalistic/milieu teaching) and b) student responses illustrating skill acquisition. Note that the *verbal* responses made by the students in the following examples may also be made by *gesturing, signing* or by using by using *communication boards or electronic devices*. Each of the four teaching techniques is indicated in bold type. Note, because each teaching episode, aimed at teaching communication skills, interferes with an activity in which the child has expressed interest, the interference should be brief, positive and result in reinforcement for the child.

Opportunities for using each of the following techniques may be increased by arranging the environment in the following ways. A teacher may make attractive materials visible but beyond the reach of learners who are likely to request assistance to get those materials. A learner may be given an inadequate portion of food or materials and is likely to indicate the desire for more. A learner may be given choices and must indicate which of them he or she wants or the learner may be given equipment such as windup toys that require assistance to operate (Kaiser (2000). It is the learner's expressed desire to get these reinforcers that provides teachers the opportunity to interfere briefly with the learner's performance while using these teaching techniques to improve student communication skill before giving the reinforcers to the learner. Kaiser (2000) provides an expanded discussion of these techniques.

Modelling Procedure

Modelling is a part of all milieu teaching procedures and can be used to teach new communicative responses.

For example, as part of a *daily activity* (e.g., recess), a child is sitting on a swing (showing interest in an object or activity - *a potential reinforcer*) while the teacher watches from the sidelines (*joint-attention*). The child looks to the teacher (the child *wants assistance*); the teacher then *models* the desired communication, "Say, push please."

- if the child imitates the model and says, "Push please," the teacher says, "You want a push" (models verbal expansion of a more complex response for future use) and rewards the child by pushing the swing (gives the child the object or activity of interest).

- if the child fails to respond correctly after the first model (the child gives a partial, unintelligible or incorrect response), the teacher gives a second model, "Say, Push please." If the child imitates the model and says, "Push please," the teacher says, "You want a push" and pushes the swing.

- if the child gives a partial response, "Push," when she or he is capable of a complete response, the teacher repeats the model "Say, Push *please*." If the child imitates the model and says, "Push please," the teacher says, "I will push you" and pushes the swing.

- if the child still fails to make the correct response, the teacher provides corrective feedback and presents the object or activity.

Mand-Model Procedure

The mand-model procedure can be used for a variety of purposes such as to generalize a known communicative response (e.g., Want ___) to a new situation, or to teach a new response. The technique is used to provide increased numbers of opportunities for students to use newly learned language skills in a variety of situations.

For example, as a part of daily activity (e.g., familiar craft activity), a teacher sets out (a variety of interesting material), paper, smocks, paint brushes and all the materials except (*absence of necessary materials*) the paint which is placed within view but *out of reach* of the student. When the student looks toward the paint and then to the teacher (joint-attention), the teacher (mands) the student to respond by questioning, "What do you want?" (requires more than a *Yes, No* response) or commands by stating, "Tell me what you want."

- if the student makes an unprompted response, "*I want* the paint," the student is given the paint along with a verbal expansion of a more complex response for future use, "Yes, you want the paint for your picture."

- if the student makes no response, the teacher *models* the desired response, "Say, I *want* the paint." If the student communicates by *partially imitating* the model, "*Want* paint," the teacher says, "Yes, you want the paint" and provides the paint.

- if the student responds with a partial response, "Paint," the teacher models an *elaborated response*, "Say, I *want* the paint." If the student imitates the elaborated response, "I *want* the paint," the teacher gives the paint.

- if the child still fails to make the correct response, the teacher provides corrective feedback and presents the object or activity.

Choice-Making Mands. Choice-making mands begin with a statement to students about available choices (e.g.,"There are cheese sandwiches and peanut butter sandwiches," followed by a questioning mand: "What would you like?") (Kaiser, 2000).

Time Delay Procedure

Time delay procedures are used to attach an established communication response to naturally occurring conditions (social or physical) while fading the use of mands and models.

For example, as a part of a daily activity (e.g., snack time), a teacher gains a student's attention (*joint-attention*) by presenting but withholding something the student is likely to want (e.g., a pitcher of juice) and waits (*time delay*: 5 seconds) for a desired communication response from the student.

- if the student spontaneously makes the desired response, "*Want juice,*" the teacher says, "You want juice" and gives the student juice.

The mand-model routine can be reintroduced after an unsuccessful time delay.
- if the student makes no response after 5 secs. the teacher prompts (mands) the student, "Tell me what you *want.*" Student replies, "Juice." The teacher says, "You want juice," and gives the student juice.

- if the student does not make the desired response, the teacher can *model* the desired response, "I *want* juice." Student imitates model, "*Want* juice." Student is given juice.

Time delay procedures may also be used by temporarily interfering with performance of a chain of behavior. For example, the teacher casually blocks a doorway or locker to which the student wishes to gain access, or a cafeteria worker withholds a student's food tray, until in each case the student makes an appropriate communication (gesture, sign, communication board) such as, "Move please" or "Tray please" (Kaiser, 2000). As mentioned, with each of these procedures the interruption/teaching episode should be brief, positive and reinforcing for the student.

Incidental Teaching

Incidental teaching methods are used to elaborate or improve upon a spontaneous request made by a student during an activity in which he or she is interested - a potential reinforcer.

For example, as a part of a daily activity (e.g., getting dressed to go outside), a student needing help to tie his/her shoelaces, makes a *request,* pulls the teacher's sleeve, points repeatedly to the shoes and grunts.

- the teacher delays responding for 5 secs. If the student says, "Tie" or "Tie shoes," the teacher replies, "I will tie your shoes" and ties the shoes.

- if the student fails to make the desired response, the teacher mands a response and asks, "Tell me what you want." If the students says, "Tie" or "Tie shoes," the teacher replies, "I will tie your shoes" and ties the shoes.

- if the student still fails to make the desired response, the teacher models the desired response, "Say, Tie shoes please." If the student imitates the model and says, "Tie shoes please," the teacher replies, "I will tie your shoes" and ties the shoes.

- if the student only partly imitates the model, "Tie shoes," the teacher may again model the elaborated response, "Say, Tie shoes please." If the student imitates the model and says, "Tie shoes please," the teacher replies, "I will tie your shoes" and ties the shoes.

Teaching Conversations Skills

McCormick (1997), discussing the conversational skills of non-disabled children, wrote that while children as young as two years of age are quite good at introducing new topics of conversation, they do not sustain a topic beyond one or two turns. Furthermore, their responses may be unrelated to those made by their conversation partners. Even by age 3.5, only 50% of the responses are topically related.

McCormick also noted that by school age, most children can:

a. sustain a simple three-term interaction where there is a comment, a request for clarification and a clarifying response;

b. introduce a topic and sustain it through several turns, then close or switch topics;

c. adjust speech for conversation partners with different and/or less sophisticated language abilities, and

d. recognize a communication partner's knowledge about a topic and eliminate information presumed to be already known.

To teach the skills of conversation to students having severe, multiple disabilities, it may be helpful to use at least two people in addition to the student. One person can serve as the communication partner, while the other person serves to prompt the student with disabilities to perform in the desired manner. Prompting may involve whispering in the student's ear telling him or her what to do in general terms or stating exactly what to say. The conversational assistant may also act as a *shill* who actively participates in the conversation *modelling* how the student should respond in the next instant when the student will be given the same opportunity.

Initiating Conversations

Teachers may arrange or take advantage of situations in which a student has a reason to initiate a conversation (e.g., wants something, wants someone's attention, wants to share information) and a means with which to initiate the conversation. Gestures and direct or indirect verbal prompts may be used to guide the student's attention to the potential communication partner. The teacher can then model initiating a conversation by using the student's most effective means of communication (e.g., gesture, manual sign, vocalization, or alternative/augmentative communication device). If necessary, the teacher can also cue the conversation partner to be very responsive to the student's efforts instead of responding to the teacher which sometimes happens (Downing, 1999).

Maintaining Conversations

Students with severe disabilities may have little difficulty gaining someone's attention, but given their characteristically limited conversational repertoire, they may find it hard to maintain a conversation. Maintaining the conversation usually becomes the task of the conversation partner.

Conversational Turn-Taking

Persons with disabilities must be able to participate in turn-taking to keep conversations going. They need to understand that when the conversation partner has stopped talking, they should *say* something in return.

Turn-taking requires both partners to carefully synchronize the timing of their utterances. They must predict accurately when the other person will stop talking. They must learn to recognize the significance of momentary gaps in speech, whether the speaker is looking for the right word, or organizing a response, rather than completing a turn. Good turn-taking does not permit overlap or interruption of speech. Participants must learn to predict on syntactic or prosodic grounds that the conversation partner has finished his/her turn. They must also recognize that a nod (affirmation) or an "Uh Huh" may be a turn.

Ideally, conversational turns are balanced so that each communicator's turns are of generally equal length. To obtain a balance, conversation partners must usually a) talk less, b) take shorter turns and c) make longer pauses giving the student with disabilities time to formulate and make a response. Adults may also increase opportunities for turn-taking by ending their turns with a question and then waiting for the response. Turns may be verbal and/or nonverbal (Kaiser, 2000).

Some turn-taking is *obligatory*. For example, following a question, an answer is expected. Other turn-taking is *non-obligatory*, for instance, when a response is not required, but can keep a conversation going, for instance, when someone says, "I'm going to a movie tonight," the communication partner can say nothing, "Great!' or "Which one?" (Downing, 1999).

Davis, Reichle, Johnston and Southard (1998) successfully improved the conversational turn-taking of two children with severe disabilities to non-obligatory statements made immediately following a series of obligatory statements. In their study, a non-obligatory statement was interspersed after a few questions that required responses and to which the students were capable of responding. The authors suggested that this procedure may have built sufficient momentum to keep the conversation going.

Downing (1999) describes a *conversation book* used by one student to initiate and maintain conversations. The student used the book in conjunction with facial expressions and body movements. The book contained Boardmaker symbols, photographs and pictures from magazines and newspapers. For example, a magazine picture of a Barbie Doll had a sentence attached saying "I collect Barbie Dolls." Another small, colored picture of a cat had

the caption, "I have a cat." A picture of an audio tape had the caption, "My favorite tape is the Beatles." The pictures and messages could be readily slipped in and out of the photo holder to reflect current interests and experiences. The student's teacher had taught her to point to pictures of her choice to give her conversational partner something to comment on or ask about. Following a response from her partner, the teacher waited two seconds for the student to respond before tapping the book to remind her. If no response was made, the teacher verbally directed the student to say something to her partner. If there was still no response, the teacher guided the student's hand to a picture and told the student to show it to her partner. The teacher waited two seconds between each level of prompting.

Terminating Conversations

There are intentional and appropriate ways to terminate a conversation. Students may be taught to say "Bye," "See ya" or some similar phrase. They may also be taught to use an alternative/augmentative communication device to convey the same message. Similarly, when the conversation partner signals that he or she is about to leave, the person with disabilities can be taught to smile, nod, or give a look of acknowledgement (Downing, 1999).

Communication and Hearing Impairments

Speech Sounds

According to Crockett, Jones, Jordan, Pickett, Shea, Blevins, Wheeler, and Lapierre (1995), the level of one's hearing loss affects the types of speech that can be heard, and therefore, that can be spoken. An individual having a mild hearing loss (15 -30 dB) will likely hear vowel sounds clearly but may miss voiceless consonants and short unstressed syllables and words.

Figure 11. Speech Sounds

Someone having a moderate hearing loss (31 - 60 dB) will have partial access to conversational speech. Spoken language will likely emerge spontaneously, but will have imperfections. Appropriately-fitted hearing aids may permit full access to speech sounds. Appropriate educational interventions will likely resolve speech and language difficulties.

With a severe hearing loss (61 - 90 dB), an individual without amplification will not hear conversational speech and will not develop oral language skills naturally and spontaneously. However, appropriate amplification will permit audible access to conversational speech and permit good sound discrimination. Problems of discrimination tend to be limited to voice quality and place of articulation for consonants. A person having this level of loss can learn oral language primarily through hearing when given appropriate intervention.

A person having a profound hearing loss (91 - 120 dB) will not be able to hear normal conversational speech without amplification. Appropriate amplification will provide only

partial hearing of conversational speech. Discrimination will likely be poor. Hearing will be insufficient to use as the primary source for learning oral language. The learner will have access to the prosodic or rhythmic aspects of speech. Lip reading may provide valuable information when combined with the individual's residual hearing.

Even with hearing aids, an individual having a loss of 121 dB or more will not hear conversational speech. The individual will perceive sound vibrotactilely and can develop spoken language primarily through the use of vision. Vibrotactile perception of speech sound may be achieved in several ways. Tadoma is a method of tactile speech reading in which an individual feels the vibrations of the throat and face, and the position of the jaw of a speaker. *Tactiling* involves placing one's hand on a speaker's shoulder with the thumb placed loosely against the side of the neck to feel laryngeal vibrations. Although this method is used by very few deaf people, Soderlund & Nordstrand (1998) claim that studies of preschool, deaf and profoundly hearing impaired students have shown a pronounced positive effect of the technique on speech production and understanding. Electronic devices for vibrotactile communication are discussed in the previous section *Vibrotactile Communication Devices*.

Because most hearing impaired individuals have some potentially useful residual hearing, even with a severe or profound hearing impairment, the auditory channel is the most effective means for teaching many aspects of speech (Crockett et al. 1995).

Hearing Aids

At all times, make certain that the student's aids are functioning properly.

A malfunctioning hearing aid may be worse than none, because wearing a dead aid may create an additional loss of 25-40 dB (Blischak & Wasson, 1997). Amplification should be used during all waking hours to make the individual aware of the environment, to maximize residual hearing, to keep the feedback loop intact and to promote self-monitoring.
In addition, since individuals with severe disabilities are unlikely to tell anyone of a hearing aid problem, their aids need to be checked regularly to make certain they are working properly, aren't too loud, or producing a lot of static or feedback.

The *Six Sound Test* (Ling, 1989) should be used at least once daily and preferably more frequently to assess functioning of all equipment. A listening check of each individual's personal aids and classroom amplification equipment should be completed by the teacher at the beginning of each day and when necessary during the day (Crockett et al. 1995).

The Six Sound Test

The Six Sound Test consists of six sounds (see the following list) representing the frequency range of all phonemes (adapted from Ling, 1989). Each individual sound is made by a teacher from a distance of 3 - 15 feet from the listener. The listener keeps his or her eyes closed and claps as each sound is heard. While the test can be individualized so that the person being tested can make any reliable response to indicate that a sound has been heard, the test requires a participant who is cooperative and trained to make a consistent response to sound perception. According to Ling, the validity of the test depends on the intensity of each sound being presented at about the same level as that found in everyday conversational speech. Also, since each sound can vary in everyday discourse according to whether it is stressed or unstressed, a person with a hearing impairment may be able to hear a sound when stressed but not when it is unstressed. To properly administer the test, one should rehearse sentences containing the sounds in unstressed words and then use the sounds in the same unstressed manner in the test.

- **m** as in: *m*an, tea*m*, a*m*

- **oo** as in: b*oo*t, *oo*ze

- **a** as in: *a*re, c*a*r, *fa*ther

- **e** as in: b*ee*, m*ea*t

- **sh** as in: fi*sh*, *sh*e, *sh*oe

- **s** as in: *s*ee, u*s*, *c*ent

The test, often used first thing in the morning before classes begin, indicates how well an individual is functioning auditorially. As a part of day-to-day diagnostics or as a specific follow-up to hearing aid selection, the test also indicates how well a hearing aid is working (Ling, 1989: *Clarke School Auditory Enhancement Guide*, 1992).

Checking Student Use of Hearing Aids Using the Six Sound Test

In addition to indicating if the hearing aid is working, the Six Sound Test can also detect other possible problems an individual may be experiencing such as a change in hearing levels related to outer or middle ear problems or a change in sensorineural hearing levels. Use the test in the following manner.

1. Have the listener sit facing you at a distance of about 3 feet.

2. Cover your mouth with an index card or piece of paper.

3. Individually present each of the six sounds.

4. For each sound, have the listener raise a hand or place a block in a container when the sound is heard.

5. Set the baseline for each student, indicating the sounds the student can hear from 3 feet, using a functioning hearing aid with a good battery. Not all students will hear all the sounds.

6. Check each student's awareness of each of the sounds on a regular basis. If hearing deviates from the student's baseline, check the hearing aid more carefully.

7. If a thorough check of the aid confirms it is working well, poor performance on the test may indicate a problem such as fluid in the middle ear (Nussbaum, 2000).

Communication and Visual Impairments

Deafblind

Students who are deafblind may use different methods of communication for receptive and expressive language than are used by other individuals. For example, a particular student who is deafblind might receive tactile sign language paired with tangible symbols, but express him/herself verbally. Therefore, it is important not to eliminate a particular form of communication from the instructional program because it cannot be used both receptively and expressively (Prickett & Welch, 1998).

In addition, it is also important to teach all the communication forms a student is capable of learning. The particular form a student uses will be determined by: a) the skills and preferences of the partners in any communication; b) the demands of various activities and situations; c) environmental conditions, and d) accessibility of communication equipment. The influence of each of these factors often changes across situations and times throughout an individual's day, as a result, so too will the forms of communication required (Prickett & Welch, 1998).

Huebner, Prickett and Welch (1995) describe the following means by which individuals who are deafblind may communicate.

Method	Explanation/example
Touch cues	Using touch cues, a *speaker* touches the body of a person who is deafblind in a particular way, prior to a specific event. For example, a light touch on a child's lips may be used to indicate eating is about to begin. A light tap beneath an person's elbow may be a cue to stand up. Repeated use of particular *touch cues* prior to specific activities encourages the recipient to anticipate those activities and begin to respond appropriately immediately following the cue.
Object cues	Actual objects (e.g., a shoe) may be presented to an individual prior to onset of a particular activity (e.g., going for a walk). A warm and fragrant cup of coffee may be presented to an individual as a means of asking her if she would like coffee. As with touch cues, repeated presentation of an object cues prior to specific activities leads the recipient to anticipate the activity following presentation of the cue. The use of object cues is a precursor to using objects as symbols.
Gestures and body language	Gestures and body language can be used when the *speaker* stays in contact with the deafblind individual. For example, a rapid movement down his or her forearm may be used to indicate speed of action; a negative response can be conveyed by having the deafblind individual feel the speaker's head move from side-to-side. "I don't know" may be communicated by having the deafblind person feel the speaker's shoulders shrug.
Tangible symbols	Tangible symbols involve the use of objects, pictures or textured materials representing specific concepts or activities. For example, a calendar box may have a tangible objects in each of its partitioned sections where each object in each section represents a particular activity at a specific time and/or day. A drumstick may be used to represent music; a ball may represent physical activities, and a spoon may indicate snack time. Tangible symbols may be used as beginning symbols for students who do not use spoken or signed language. Alternatively, the symbols may used as an adjunct to speech and/or signs to provide a concrete referent.
Sign language	Sign language uses hand and arm movements, natural gestures, as well as body and facial movements and expressions.
Tactile sign language	With tactile sign language, both the person signing and the receiver may use touch, or the receiver alone may use touch and then sign back visibly and/or speak.

Fingerspelling	Fingerspelling involves the use of hand shapes that symbolize letters of the alphabet that can be read visibly or be recognized through touch.
Spoken language	Spoken language involves using natural forms of verbal communication requiring use of a deafblind person's residual hearing. American Sign Language (ASL) is often used with students who are deaf or deafblind. Manually Coded English (MCE), a modified form of sign language, is also used.
Braille	Braille language is printed in an embossed form so that it can be read by touch.
Large print	Large type is presented on a computer or printed page. The larger the type, the more readily it may be seen, but the more difficulty one might have trying to put the pieces together to from a coherent communication.
Print on palm	The *English Deafblind Manual Alphabet* involves using one's index finger to print in block letters on a person's palm; may involve spelling words letter by letter; requires the deafblind person to have strong spelling and language skills

Adapted from Huebner, Prickett and Welch (1995).

Communication Technology/Computers

The Trace Center, College of Engineering, University of Wisconsin-Madison operates a Web site providing information on, among other disability-related topics, communication technology. Some of this information is briefly described below.

http://trace.wisc.edu/

Information Resources for Blind and Visually Impaired

This address shown below lists a number of sources of information for computer users with visual impairments. Some of the equipment described is: optical character readers, speech synthesizers, screen magnifiers, closed circuit television and Braille for Apple and IBM computers. Other information refers to talking book libraries, computer training programs, computer assessment and training on adaptive devices, software, computer user's groups for blind and visually impaired, Braille computer reference books, etc.

http://trace.wisc.edu/docs/quick_sheets/qs6.html

Computer Access Products for Blind and Visually Impaired Users

The address shown below lists manufactures and developers of products to help people with visual impairments use computers. Various output devices are described: synthesised speech, large print and Braille or other tactile output devices designed to provide access to standard commercial software such as word processors and spreadsheets. Some of the equipment described is: screen magnification software, software for reading documents with the use of computers, screen readers, note-taking instruments for people with blindness, Braille in various languages, Web browser programs, Braille printers, speech synthesizers, scan/read systems, screen clarifiers, large-bold keycaps and word-predictive word processing.

http://trace.wisc.edu/docs/quick_sheets/qs5.html

Keyboard Modification Programs

The software companies listed at the address below provide methods for making keyboard modifications permitting persons with disabilities, mainly physical, to use computer keyboards. The programs described allow single finger operation of keys like the shift key and typing acceleration programs that increase the number of letters that can be typed with the same number of keystrokes. These programs include abbreviation expansion and word prediction programs. Keyboard redefinition programs permit users to rearrange the keys on keyboards for individuals needing a different key layout. Some of the devices and programs described are: word prediction programs, speech output devices, alternative mouse controls, alternative keyboards, one-handed keyboard software, on-screen keyboards permitting input by alternative devices and speech input/output.

http://trace.wisc.edu/docs/quick_sheets/qs16.html

Speech Synthesizers and Speech Input Systems

Information regarding speech synthesizers and speech input systems can be found at the following two Trace sites.

http://trace.wisc.edu/docs/quick_sheets/qs29.html

http://trace.wisc.edu/docs/quick_sheets/qs27.html

Head-Pointers, Light-Pointers and Mouth-Sticks

The Trace site listed below describes sources of devices that can be used to point and to manipulate without using one's hands. These devices include head-pointers (head mounted sticks) used to point to objects or to press switches and keys on keyboards; light-pointers, usually worn on one's head, to direct a beam of light can to point to objects and to communication board symbols - can also activate specially designed keyboards; and mouth-sticks having writing tips, page turners and grabbing devices.

http://trace.wisc.edu/docs/quick_sheets/qs14.html

Adaptations to Computers

In addition to the adaptations referred to in the foregoing discussion, Taylor and Murphy-Herd (1998) suggested a number of practical modifications that can be made to computers to accommodate individuals having visual impairments. Many of the adaptations suggested for learners with visual impairments are suitable for a variety of students.

To Improve Access: (adapted from Taylor, Murphy-Herd, 1998).

1. Try moving the monitor closer to the user.
2. Try an external screen magnifier.
3. Try a larger monitor.
4. Try increasing the font size and/or changing the style of font
5. Try changing the color of the background and/or the font to provide figure-ground constrast.
6. Try reducing or eliminating sources of glare; put a light shade around the monitor.

Figure 12. Computer, Monitor and Keyboard

7. Try an on-screen keyboard with a *TouchWindow*, a clear window placed in front of a computer monitor; selected parts of the screen are activated by finger pressure; the touch screen emulates mouse functions like click, double click and drag. Available from Screens, Inc. Some touch screens can be activated by finger, fist, palm, or pen/stylus.

http://www.touchwindow.com/

8. Try a specialized keyboard like the *Unicorn* that replaces both the mouse and the traditional keyboard. The *Unicorn expanded keyboard* is a 128 touch sensitive, square board. Larger than a computer keyboard, it can be reconfigured to accommodate 2, 3, 4 or more, large or small pictures to accommodate the visual and/or motor skills of various users. The amount of pressure or time needed to activate a square can also be modified to accommodate users with various degrees of motor control (Unicorn Engineering).

Figure 13. Roller Ball

When a User Has Difficulty Using a Mouse.

1. Try using a trackball (Figure 13); they are usually more stable and the action of clicking the mouse does not tend to move the cursor; the *Roller Plus Trackball* by *Infogrip* permits the speed setting or responsiveness of the trackball to be changed (Bruni, 1998).

2. Bruni (1998) also suggested use of a track pad (Figure 14) in which the user moves the cursor by tracing his or her finger across a pad that looks like a small screen.

Figure 14. Track Pad

3. Try using a joystick (Figure 10) that is grasped by the whole hand; variable speeds, sensitivities and sizes are available.

4. Try using an optical pointer such as *Headmaster Plus* (Prentke Romich Co.) that moves a cursor to a spot on a screen keyboard by an infrared beam controlled by user's head movement and is then activated by puffing, blowing or sipping on a tube placed between user's lips.

http://www.prentrom.com

See also *HeadMouse* (Origin Instruments) that replaces the standard desktop mouse. *HeadMouse* is a wireless optical sensor that tracks movement of tiny targets placed on a user's forehead or glasses. When used in conjunction with an on-screen keyboard the *HeadMouse* can completely replace the functions of a conventional keyboard. *HeadMouse* tracks the user's head when the user is located in any comfortable position relative to the computer display. Used in conjunction with *Talking Screen*,

the user can make a selection by holding the cursor on a symbol or character for a period of time to produce speech.

http://www.orin.com/access/headmouse/

http://www.words-plus.com/website/products/input/headms.htm

5. Try making adjustments in the computer's control panel to increase or decrease the rate of responsiveness of the mouse.

6. Try using speech recognition programs, rather than a keyboard or mouse, that operate computers with speech input; the computer is programmed by the speaker to recognize variations in an individual's voice and the voice patterns of multiple speakers.

7. Try using specialized keyboards that replace the function of both the mouse and the regular keyboard. Specialized keyboards are discussed in the next section.

Some software (Bruni, 1998) provides a broader area of selection so that when the cursor gets close, it selects the item. This is know as creating *hot spots*. There are also some computer programs that respond positively to any movement of the mouse or touch of the keyboard (e.g., *Jumpstart Toddlers*; *Reader Rabbit Toddler*).

When a User Has Difficulty Using the Keyboard.

1. Try using word-prediction software that minimizes the number of keystrokes required to type a word.

2. Try using macros to decrease the number of repetitive tasks.

3. Try using a keyboard overlay that reduces the number of choices a student must make and that offers pictorial rather than alphanumeric choices.

4. Try using a keyguard - a plexiglass cover with individual holes for the keys; makes it difficult to press multiple keys at one time; permits users to rest their hands on the keyboard.

5. Try raising the rear of the keyboard so that the student can more readily see the keys.

6. Try making adjustments on the computer's control panel to change the

keystroke response rate to avoid more than one letter being typed with a single, long depression of a key.

7. Bruni (1998) recommends two specific alternative keyboards that may be suitable for young children having Down syndrome: the *Discover Board* by Don Johnston Inc. and *IntelliKeys* by *IntelliTools*, Inc.

Discover: Board/ *Discover:Screen*. The *Discover: Board* takes the place of both mouse and keyboard. The size and color of the keys can be changed, and pictures and words can be added. For students who can't read, pictures are displayed that permit symbolic writing. For word bank readers, complete words and phrases are displayed for constructing sentences. For single-letter writers, the *Discover: Board* is a full keyboard. *Discover: Screen* is an on-screen representation of the *Discover: Board* for use by students who can use a trackball or touch screen.

http://www.donjohnston.com

IntelliKeys Keyboard. *IntelliKeys* is an alternative keyboard for *Windows* or *Macintosh* computers to accommodate physical, visual and cognitive disabilities. The device uses a variety of overlays (six standard, alphabetical, numerical, and arrow) and an optional keyguard. The QWERTY keyboard has large, well spaced letters and numbers and is useful for people having strong cognitive and visual skills but limited fine-motor abilities. The keyboard can be used with any word processing program or software. Adjustment can be made to the response or repeat rates for individuals who tend to press unwanted keys or keep their fingers on the keys too long. *Overlay Maker*, *IntelliTalk*, *IntelliPics* and *ClickIt* assist design of custom overlays. *Overlay Maker* creates customized overlays using various shapes, sizes, text, pictures, clip art, photos and drawings.

http://www.intellitools.com

Unicorn Expanded Keyboard. This keyboard is a 128 touch sensitive, square board. The keyboard is larger than a computer keyboard and can be reconfigured to accommodate 2, 3, 4 or more, large or small pictures, thereby accommodating the visual and/or motor needs of various users. The amount of pressure or time needed to activate a square can also be modified to accommodate users with various degrees of motor control. An arrow overlay replaces the need for a mouse. Commonly used in schools. Available from Unicorn Engineering.

When a User Cannot Read Text or Graphics.

1. Try using a screen reader; using the numeric pad to control the screen

reader, users can listen to single letters, words or sentences.

2. Try using a talking word processor program that reads what is being typed.

3. Try word prediction programs to improve user spelling, grammar and typing speed while reducing the number of keystrokes. For example, a user may type the first few letters of a word and the prediction program will suggest the remaining letters in the word - a particularly useful approach for users having poor spelling and motor skills.

Microsoft Windows Resources for People with Disabilities

Microsoft provides *Accessibility Guides* describing a) accessibility products available from independent manufactures and b) methods for adapting Microsoft products for vision, hearing, mobility, cognitive and language impairments. The guides are designed for people with disabilities, teachers, parents, family members and others to make computers accessible for people with disabilities. These guides describe the following access utilities that are either selectively, user installed, or installed by default in one or more of the following programs: *Microsoft Windows 98, Microsoft Word 2000, Microsoft Windows Millennium, Microsoft Internet Explorer 5, Microsoft Outlook 2000.* Other features are also available on some programs.

http://www.microsoft.com/enable

1. *Accessibility Wizard:* takes people with hearing and mobility needs through a series of questions to customize *Windows ME.*

2. *StickyKeys:* for people who have difficulty pressing two keys at the same time; the CTRL, ALT and SHIFT keys remain active once pressed.

3. *FilterKeys:* adusts the keyboard response to ignore unintended repeated keystrokes.

4. *Sound Sentry:* part of the screen flashes every time the system's built-in speaker plays a sound.

5. *Show Sounds:* make applications display captions for the speech sounds they make.

6. *High Contrast:* improve screen contrast with alternate colors and font sizes for easy reading.

7. *Keyboard Enhancement Utilities:* for people who have trouble typing, the filters built into *Microsoft Windows,* and *Microsoft Windows NT* compensate

for erratic motion, tremors and slow responses.

8. *Intellipoint Features:* numerous cursor modifications can be adjusted through the *Windows* Control Panel such as changing cursor size and speed.

9. *Microsoft Magnifier:* creates a separate window in which selected portions of the screen are magnified; may be adjusted to include High Contrast, Color Inversions and different level of magnification.

10. *On-screen keyboard:* allows people with mobility impairments, or who do not know how to type, to type using only the mouse.

11. *Mouse Keys:* enables use of the numeric keypad to move the mouse pointer, click, double-click and drag.

Apple Resources for People with Disabilities

Apple Computers offers a similar number and type of *Accessibility Features* included in the *Macintosh* system software (System 7.x, 8.x, and 9.x), plus step-by-step instructions for installing these features.

http://www.apple.com/education/k12/disability/

COMMUNICATION DOMAIN LEARNING INDICATORS

PRAGMATIC FUNCTIONS

The list of pragmatic functions that follows is adapted from Donnellan, Mirenda, Mesaros & Fassbender (1984); Dore, (1977); Downing 1999; Miller, (1981); Orelove and Sobsey (1996); and Roth and Spekman (1984). Non-symbolic methods of pragmatic communication are discussed in Seigel and Wetherby (2000); Wetherby, Yonclass and Bryan (1989). Reichle and Sigafoos (1991) describe method for establishing requesting responses.

According to Orelove and Sobsey (1996), published pragmatic assessments of communication among people with severe disabilities are rare and there is no generally agreed upon list of pragmatic functions available for persons with severe disabilities.

Most of the pragmatic functions listed below may involve the use of gestures, signs, speech, and/or Augmentative or Alternative Communication (AAC) including communication boards or electronic devices such as speech synthesizers.

Before beginning instruction in pragmatic communication, teachers should know how students of the learner's age characteristically attract attention, greet each other, and perform other pragmatic functions in environments within which the learner performs. One of the objects of instruction should be to teach age-appropriate methods of interacting (Downing, 1999).

Note: In the *learning indicators* that follow, for sake of brevity, rather than using the term *conversational partners*, conversations are conducted between *learners* (people having moderate or severe, multiple disabilities) and *conversers* (teachers, aides, parents, peers and others). **Note also:** that conversers must be responsive to the learner's attempts to communicate, build on existing communication skills, give the learner control over the environment, and use conversational responses as natural reinforcers.

Attending (Eye-Contact)

Attending is not generally classified as a pragmatic function, but in many circumstances eye-contact can function as a non-verbal form of communication influencing conversers so that they will perform in ways desired by the learner. Eye-contact, frequently absent or reduced among persons having autism, functions to acknowledge other people and serves to initiate or maintain a relationship or an interaction. The function of each type of eye-contact listed below is indicated in italics.

- (*Aknowledgement and Relationship Maintenance, ARM*) makes eye-contact when someone sitting directly in front says "Look at me."

- (*ARM*) makes eye-contact when someone sitting directly in front calls his or her name

- (*ARM*) makes eye-contact when someone within 8-12 feet says "Look at me," or calls his or her name

- (*ARM*) makes eye-contact when familiar staff, family, peer, fellow worker or a stranger within 8-12 feet says "Look at me," or calls his or her name

- (*ARM*) makes eye-contact with person speaking to a group of which he or she is a part (e.g., Teacher, aide, foreman, or mother says "Look up here," "Look," "Look at me" or "Everyone."

- (*ARM*) makes eye-contact with person (familiar or unfamiliar) who greets him or her with "Hello" or "Hi."

- (*initiates interaction*) makes eye-contact with someone nearby to encouraging them to interact with him or her

- (*secures attention to insure his or her efforts to communicate will be observed*) establishes mutual eye-contact before or as he or she begins to talk to someone

- (*maintains conversation*) during conversation/interaction makes eye-contact of appropriate frequency and duration to indicate that he or she is involved in the interaction, without staring at the other person or appearing to be distracted by something or someone else

- interprets enduring eye-contact made by someone else as a possible cue to interact or relate in some manner

- interprets reduced frequency or duration of eye-contact made by someone with whom he or she has been interacting as a possible cue to discontinue relating

Attracting Attention

Attracting the attention of an intended converser before beginning communication is an essential but often overlooked step in the process. Different forms of attracting attention may direct the intended *converser* to a) "Look at me," b) "Listen to me," or c) "Look at that."

- proximity: the learner moves close to the intended *converser* (within his or her visual field); stands, sits beside or sits on the converser's lap

- visual: establishes eye-contact with the intended converser

- gestural: waves or raises hand (only effective if the intended converser is already looking in the general direction)

- tactile: taps intended converser's hand, or tugs on converser's clothing to gain attention

- vocal: cries, yells, calls the intended converser's name or says, "Hey, look at me." (more effective over long distance in distracting conditions)

- AAC: uses a sign to attract and/or focus attention on self, other person, object or activity, and/or to indicate whether to look and/or listen

- AAC: rings a bell or buzzer (most effective but perhaps not portable)

- AAC: uses a communication board to focus attention on a particular person, object or activity; may also indicate if communication partner should look and/or listen

- in the presence of caregiver, a learner continues to make a persistent attention-getting behavior (e.g., banging, shouting or crying but not speech) until the caregiver acknowledges by greeting or calling the learner's name, going to and/or picking-up the learner

- if the learner fails to gain attention using an attention-getting behavior, he or she increases the intensity of the behavior

- if the individual fails to gain attention using one attention-getting behavior, tries effectiveness of other attention-getting behaviors

Making Requests

Indicates "Want"

- the learner indicates *want* of a nearby object, person or activity by gazing at it for a period of time
- requests (verbal, gestural, sign and/or AAC) an object or activity that is in the immediate environment and visible to the learner
- requests an object or activity that is not in the immediate environment and that is not visible
- indicates *want* by vocalizing (not speaking) and reaching for and/or gazing at an object, person or activity
- indicates *want* by reaching for, or grabbing for, or pointing to an object, person or activity *without attending* to a caregiver
- indicates *want* by reaching or grabbing for, or pointing to a target object, person or activity out of reach *while looking* at a caregiver or alternating eye gaze between the target and the caregiver
- obtains nearby caregiver's attention before making a request
- goes close to a distant person before making a request of him or her
- goes close to a distant person and gains his or her attention before making a request
- pulls a caregiver to an object or activity as a means of gaining the caregiver's assistance in obtaining the object or activity
- presents a caregiver with an object or toy that requires activation, winding or turning on
- requests "Ride" or "Carry me" by reaching toward an adult
- requests "Want juice" by holding up a glass or by going to the fridge
- requests "Pee-pee" by holding his or her crotch

- requests assistance by moving toward an adult when unable to remove coat or put on shoes

- requests assistance by holding up his or her hand (e.g., classroom situation)

- requests assistance by saying, "Need help" or "Can't do."

- in the presence of caregiver, requests attention, assistance, and object, person or activity by using persistent attention-getting behavior (e.g., banging, shouting or crying, but not speech) until the caregiver responds as desired

- if the learner fails to obtain his or her request by using an attention-getting behavior, increases the intensity of the behavior

- if the individual fails to obtain his or her request by using one attention-getting behavior, tries effectiveness of other attention-getting behaviors

- uses a sign to indicate *want* (e.g., ASL: brings palms of both hands up in front of abdomen; flexes fingers as if grasping a softball; pulls both arms/hands toward chest)

- uses speech, sign, or selection of graphic to indicate "Want ___ (the name of a desired object, person or activity)"

- uses speech, sign, or selection of graphic to request *general* classes of objects: drink, food or play

- uses speech, sign, or selection of graphic to request *specific* objects: Coke, banana or blocks

- indicates the need for information simply by exposing one's palms in front of the body

- requests information about an object action, activity, location ..., (e.g., "Going?" communicated by going toward the closet while looking at the converser)

- requests information by stating a word or phrase in which the pitch or rhythm of voice rises toward the end (e.g., g*O*?)

- requests information by asking an explicit question (e.g., "Are you going?" "Where going?" "Mommy go?")

Indicates "What's that?" or "Who is that?"

- when presented with an actual or pictured unknown object asks, "What's that?" or looks quizzically at converser who may be able to provide information, or exposes his or her palms in front of body and/or cocks head to side

- when presented with an actual or pictured unknown person asks, "Who is that?" or looks quizzically at converser who may be able to provide information, or exposes his or her palms in front of body and/or cocks head to side

Expresses Negations, Protests, Rejects

Sigafoos and Reichle (1991) provide a description of methods for teaching rejecting responses.

Function of Protest

- the learner protests being presented with an undesirable event, person, activity or object

- protests failure to be given a desired object, person or activity

- protests termination of an activity, departure of a person, or removal of an object

- protests continuation of an activity, departure of a person, or removal of a desired object

- protests someone else receiving an object, person or activity the learner wants

Form of Protest

- the learner tightly closes mouth, or turns head away to protest being fed

- protests activity, object or task by becoming tense and/or by frowning

- protests by crying or sobbing

- rejects by pushing or throwing objects or food away

- physically pushes other's hand away to terminate an activity like physical prompting or playing with a toy

- rejects by attacking others, pinching, screaming, biting, or

kicking

- rejects by self-abusing, scratching, biting self, or banging forehead

- rejects by verbalizing (not speaking), (e.g, yells, screams, cries, whimpers)

- rejects by stating, "No!" "Uh Uh" "I don't like/want to ...." "Stop!"

- rejects a person, object or activity by naming a more desired alternative (e.g., when given milks says, "Juice")

- points to a "No" symbol on a communication board or pushes the "NO!" button on a voice output communication aid

- rejects by using American Sign Language: raises right arm in front of body; clenches fingers to palm except index and middle fingers that are quickly brought together to touch the end of the thumb

- rejects by passive resistance, becomes limp and falls to floor

- rejects by avoiding (e.g., hides from a person, object or activity)

- rejects by escaping, runs away from an ongoing person or activity or object

- rejects an object, person or event by shaking head back and forth

- makes a generalized *rejecting* response (e.g., rejects all food)

- makes a specific *rejecting* response (e.g., rejects turnips)

- cries in response to termination of an activity such as toys being put away

- protests someone's possession of his or her belongings, "Mine!" "Give me that."

- continues to make a persistent protestation (e.g., banging, shouting or crying but not speech, until a caregiver leaves or removes an object or an activity)

- when the learner fails to achieve removal of an object or termination of an activity using a protestation, increases the intensity of the behavior

- when the learner fails to achieve removal of an object or termination of an activity using a protestation, tries the effectiveness of other forms of protestation

Responds to Requests

Supplies Requested Information

- answers the following questions:
  a) "What is your name?"
  b) "How old are you?"
  c) "Where do you live?"
  d) "What do you like to eat?"
  e) "What T.V. shows do you like?"
  f) "What is your brother's/sister's/mother's/father's name?"

Makes Choices.

- the learner pushes object or person away, or walks away when asked a question (e.g., Do you want me to help you?")

- nods, shakes head from side-to-side following a question (e.g., "Want juice?" May respond using verbal language, signs, gestures, communication board and/or speech synthesizer)

- given a non-preferred item or activity and the request "Do you want ___?" shakes head, frowns, moves or looks away, says "No!" or "Uh-uh. " May respond using verbal language, signs, gestures, communication board and/or speech synthesizer

- given a preferred item or activity and the request "Do you want ___?" nods head up-and-down, moves toward, smiles, looks at, says "Yes" or "Uh-huh." May respond using verbal language, signs, gestures, communication board and/or speech synthesizer

- offered a preferred and a non-preferred item and the question, "What do you want?" points to, touches, takes and/or labels the preferred item. May respond using verbal language, signs, gestures, communication board and/or speech synthesizer

- offered two preferred items and the question "Do you want a ___ or a ___ (names of items)?" points to, reaches for, grasps, labels, signs one of the choices

- says, "Yes or No" following a question (e.g., "Want bath?"). May respond using verbal language, signs, gestures, communication board and/or speech synthesizer

- makes a choice (touches; points to; grasps; labels or uses a voice synthesizer) one of two items offered in response to "Do you want ___ (e.g., milk or juice)?" or "What do you want?"

Responds to "Where is ...?" questions.

- in response to "Where is ___(nearby person, activity or object)?" points to object, person and/or event (e.g., in response to "Where is the ball?" points to the ball)

- in response to "Where is ___(out-of-sight person, activity or object)?" names location (e.g., in response to "Where is ___?" says, "Mommy store," "Daddy work," or "Spot outside"), or points or looks toward out-of-sight location

- responds to simple question with a gesture and/or vocalization (e.g., in response to "Where's Spot?" points to dog and/or says "Bow wow")

Expresses "Don't know."

- in response to a question or request for information for which the answer is unknown (e.g., "What's his (a stranger) name?" "How far is it to ___ (unknown location)?) shrugs shoulders, shakes head side-to-side and/or says "I don't know." May respond using verbal language, signs, gestures, communication board or speech synthesizer

Complies with Request

Follows One- and Two-Step Instructions

- the learner, in response to requests such as "Point to the ___," "Touch the ___" or "Give me ___" and an array of actual or pictured objects or people, will touch or point to the named:

a) body parts: head, nose, ear, eye, mouth, arm, elbow, hand, finger, thumb, stomach, leg, knee, ankle, foot, toe

b) people,

c) common home/school objects: dish, cup, glass, knife, fork, table, chair, fridge, microwave, light, bed, book, pencil, desk, board;

d) clothing: shoe, sock, pants, skirt, sweater, jacket, blouse, shorts, brassiere, belt, tie

- in request to "Go to the ___ (familiar location in home, school or work site)," will go, as appropriate to the bedroom, bathroom, kitchen, basement, upstairs, gym, classroom, cafeteria, auditorium, or office

- the learner, in response to the request "Brush the doll's teeth" *or* "Comb the doll's hair," performs the appropriate task *when only the corresponding toothbrush or hair brush is present*

- in response to the request "Brush the doll's teeth" *or* "Comb the doll's hair," performs the appropriate task *when the toothbrush and the hair brush are both present*

- in response to the request "Put the doll's hat on" *or* "Put the doll's shoes on" performs the appropriate task *when the doll's shoes and hat are both present*

- in response to the request "Clean the lunchroom table," performs the task *when the object of the action (the lunchroom) is not immediately present when the request is initially made*

- in response to the request "Clean the lunch room table and empty the trash," performs the tasks *when the objects of the action (lunchroom and trash) are not immediately present when the request is initially made*

- follows one- and two-step instructions that must be performed a) immediately, or b) after 5, 10, 15 or 30 minutes, or 1, 2 or 3 hours, or after a particular event or activity. For example: "After dinner, take the dog for a walk." "When you have cut-out all those pictures, glue them on this poster." "After snack put the dirty dishes in the sink and wash the table."

- complies with requests such as:
  "Come here."
  "Line-up."
  "Put your hand up."

"Sit down."
"Shut the door."
"Turn on the light"
"Put this in your desk/ on the shelf."
"Come here and sit down."
"Bring your picture book (in next room) to me."
to me."
"Get your folder/library book/spelling book."

- follows instructions and requests given by teacher, coach, parent, peer, group leader

- responds to requests addressed to the group of which she or he is a member (e.g., "Put your work away and go to the reading centre.")

- terminates preferred activity when requested

- begins less preferred activity when requested

Describes in Response to Request

- the learner describes events, actions, properties, conditions, processes, or people past, present or future:
"My name, telephone number, identification number and/ or address is ___." May respond using verbal language, signs, gestures, communication board or speech synthesizer

"I am waiting for the water to boil."
"She is my friend."
"These apples are ripe."
"See my red shoes."

Names Objects or Events

Although labelling objects is a common component of language programs for students with severe language impairment, Orelove and Sobsey (1996) state that these advanced communication skills should not be considered for training until most of the previously described basic communication functions have been mastered.

The authors also suggest that individuals with multiple disabilities can communicate in the absence of labelling skills. Teaching a general match-to-sample (picture-to-object) strategy

to facilitate learning of labels is recommended (Orelove & Sobsey, 1996).

- labels body parts in response to "What is this?" (e.g., head, nose, ear, eye, mouth, arm, elbow, hand, finger, thumb, stomach, leg, knee, ankle, foot, toe)

- names common objects (actual or pictured) in response to "What is this?" (e.g., dish, cup, glass, knife, fork, table, chair, fridge, microwave, light, bed, book, pencil, desk, board, apple, tree, house, ball)

Names Actions

- given demonstrations and/or pictures of actions and the question "What is she or he doing?" labels the action (e.g., standing, sitting, running, eating, drinking)

Responds to "Who is this?" Questions

- names familiar people is response to "Who is this?": "Mom" or "Mah;" "Dad" or "Dah;" "Wayne," "Judy," "Mrs. Gold," "Mr. Smith"

Describes Locations, Directions and Times

Describes locations, directions and times (e.g., "The car is there." "The book is on the shelf. "He left at lunch.")

- names common rooms in response to being in a specific room and asked, "Where are we?" (e.g., bedroom, bathroom, kitchen, basement, upstairs, gym, classroom, cafeteria, auditorium, office)

- describes common community location in response to "Where are we?" (e.g., school, store, McDonalds, doctor's, dentist's, beach, downtown, Gramma's house, park)

Describes Personal State: Beliefs, Attitudes, Emotions, Discomfort, Injury, and Fatigue

- looking at people or pictures of faces expressing emotions, in response to "How does he or she feel?" answers "Happy," "Sad," "Angry or Mad," "Afraid," "Tired,"

- "I'm afraid of snakes." "I don't like spinach." Holds stomach

with pained expression on his face. Limps on one foot. "Me sad." "No like."

Provides Affirmation

- the learner conveys agreement about or willingness to engage in a particular event or action: smiles, relaxes, reaches for something, approaches, points at something, looks at something

Comprehends a Converser's Non-Symbolic Communication

- the learner responds differentially to a smile or frown (e.g., continues or discontinues an activity and/or approaches or withdraws from someone; smiles or frowns in return)

- responds differentially to a loud or soft voice (e.g., discontinues activity when spoken to in a loud voice; withdraws and frowns or cries)

- orients to look at the object, person or activity toward which a converser gazes

- orients to look at the object, person or activity toward which a converser points

PARTS OF SPEECH

Nouns

Receptive

- in response to "Point to ___," "Touch ___," "Pick up ___," the learner will perform the corresponding action on:

a) body parts (e.g., head, nose, ear, eye, mouth, arm, elbow, hand, finger, thumb, stomach, leg, knee, ankle, foot, toe) or

b) common objects (e.g., dish, cup, glass, knife, fork, table, chair, fridge, microwave, light, bed, book, pencil, desk, board, apple, tree, house, ball)

Expressive

- labels body parts in response to "What is this?" (e.g., head,

nose, ear, eye, mouth, arm, elbow, hand, finger, thumb, stomach, leg, knee, ankle, foot, toe)

- labels common objects (actual or pictured) in response to "What is this?" (e.g., dish, cup, glass, knife, fork, table, chair, fridge, microwave, light, bed, book, pencil, desk, board, apple, tree, house, ball)

Pronouns

Receptive

- when the teacher is standing and the learner is sitting and the teacher asks:

a) "Am I sitting?" the learner answers, "No."
b) when the teacher ask, "Am I standing?" the learner answers, "Yes."
c) when the teacher asks, "Are you sitting?" the learner answers, "Yes."
d) when the teacher asks, "Are you standing?" the learner answers, "No."

- when a third person is standing, sitting, running or performing some other common action, and the teacher asks "Is he or she running (or sitting, or standing, etc.)?" the learner answers, "Yes," or "No" as appropriate

- when a male and a female are standing in front of the learner, and the female is clapping her hands and the teacher asks,

a) "Are her hands clapping?" the learner answers, "Yes."
b) "Are his hands clapping?" the learner answers, "No."
c) reverse the conditions randomly

Expressive

- when the learner is standing and the teacher is sitting and the learner is asked "Who is standing?" the learner answers, "I am standing." When asked who is sitting, the learner answers, "You are sitting."

- when a third person (male or female) is standing, sitting, running or performing some other common action, and the teacher asks "What is she/he doing?" the learner answers,

"He/she is running, standing or sitting" as appropriate

- when a male and a female are standing in front of the learner, and the female is clapping her hands and the teacher asks:
  a) "Whose hands are clapping?" the learner answers, "Her hands."
  b) when the male's hands are clapping and the teachers asks, "Whose hands are clapping?" the learner answers, "His hands."
  b) reverse the conditions randomly

Verbs

Receptive

- asked to perform familiar actions (e.g., stand, sit, run, eat, drink), performs the corresponding action

Expressive

- given demonstrations and/or pictures of familiar actions and the question "What is she or he doing?" labels the action (e.g., standing, sitting, running, eating, drinking)

Adjectives

Receptive

- asked to color an object using a familiar color (e.g., red, green, blue, yellow), the learner will color the object the corresponding color

- asked to pick-up, touch, point to (e.g. the big-biggest, small-smallest; the round, square), the learner will select the requested action

- performs the following actions, "Touch *your* foot." "Point to your nose." "Touch *my* hand." "Touch *my* ear."

Expressive

- asked "What color is that?" the learner will indicate (sign, label, etc) the color of the object (e.g. red, yellow, green, blue)

- asked "Is this ___ (big or small; round or square, etc.)? the

learner will indicate (sign, label) the characteristic of the object

- when the learner sees the teacher touch the learner's hand or another child's hand and is asked the question, "Whose hand am I touching?" the learner answers as appropriately "My hand," or "His or her hand."

- when the learner claps his hands or when the teacher claps her hands and is asked "Whose hands are clapping?" the learner answers as appropriate, "My hands," or "Your hands."

Prepositions

Receptive

- given the command "Put this ___ (in, on, under, beside, on top, underneath, in front of, next to) the ___ (a referent object, e.g., book, box, shelf, cup)," the learner will perform the corresponding action

Expressive

- asked "Where is the ___ (object) placed?" the learner will *state* the spatial position of the object as (e.g., on, under, in front of) a referent object. The learner may use signs, a communication board or a speech synthesizer

AUGMENTATIVE/ ALTERNATIVE COMMUNICATION

Gestural Communication

Gestures are the primary form of communication for individuals having severe, multiple disabilities, an absence of speech and limited ability to use graphic, sign or technological aids for communication. In the present context, *gesturing* is broadly defined as physical arm/hand movement such as pointing and reaching; miming; facial expressions; body language such as leaning toward or turning away; physical contact such as leaning into, touching and pulling, and changes in proximity.

Expressive Gestures

Attention Seeking Gestures.

- the learner waves arms, hits own head, hit noisy object
- touches or pulls on caregiver's hand, sleeve or leg
- touches someone to show affection, or give comfort
- gazes at someone to draw and hold their attention and prompt interaction
- points to obtain joint-attention to an object, person, sound or event of interest
- approaches someone to obtain their attention while holding an object toward the person, but does not give the object to them (Mustonen, Locke, Reichle, Solbrack & Lindgren, 1991)
- approaches someone while holding an object to give the object of interest to the person; if the object is not accepted, the child may place the object on the person's lap (Mustonen et. al, 1991)

Acceptance Gestures.

When presented with a preferred object, activity or person:

- the learner smiles, moves toward
- nods head up and down
- reaches for person or object

Acknowledgement Gestures.

- the learner waves and/or nods at person approaching or speaking
- gives visual attention; smiles at nearby person
- reaches for and/or touches a nearby person

Rejection Gestures.

When presented with a non-preferred object, activity or person:

- the learner moves or looks away or down
- frowns or makes "disapproving face"
- shakes head back and forth

- pushes object or person away
- throws food or object away
- flails hands at side of his or her head, picks at scabs on arms, bangs head or otherwise abuses self to indicate "Stop," "No more" or "Go away."

Indicating Want Gestures.

- the learner points or reaches toward a desired object, activity or person
- gazes at a person, object or activity
- holds crotch to indicate need to toilet
- puts fingers in mouth to indicate desire to eat or drink
- goes toward the refrigerator to indicate the desire to eat
- flails hands at side of his or her head, bangs head, picks at scabs on arms, or otherwise abuses self to indicate "I need help."
- holds an empty cup or glass toward someone indicating the desire to drink
- goes toward the television to indicate the desire to have it turned on
- touches or pulls on caregiver to get their participation in an activity

Requesting Assistance Gestures.

- the learner offers someone a mechanical toy or other device that requires them to wide-up, turn-on or otherwise activate
- points or reaches toward an object beyond reach to have a caregiver give it to him or her
- points to record player, tape recorder or wind-up toy that has just finished playing to have a caregiver re-activate it

Receptive Understanding of Gestures

- the learner responds to simple gestures (e.g., wipes or washes mouth in response to seeing a caregiver make a wiping

motion across the caregiver's mouth)

- becomes quiet when a caregiver places a upright forefinger in front of the caregiver's lips
- approaches when a caregiver beckons by repeatedly drawing a cupped hand toward the caregiver
- stops an activity when a caregiver raises a flat, upright palm toward the learner

Uses Signs for Communication

Pre-Signing Motor Skills

Each of the following motor behaviors is used in the production of signs. The material is adapted from Reichle (1991) where each hand position is graphically illustrated.

Prehension Patterns.

- *neutral hand:* the learner extends relaxed fingers; palm down or at a slight angle
- *squeeze:* as above, curls fingers in as if clawing without touching the palm; palm is down or at a slight angle
- *palmer grasp*: curls fingers into the palm
- *thumb adduction:* draws thumb into the side of the hand/forefinger or palm
- *mid-position of the forearm:* puts thumbs up with palms facing each other when forearms are rotated to mid-position
- *thumb abduction:* moves thumb away from the hand, forefinger and palm
- *wrist flexion-extension:* bends hand up or down at the wrist and rotates in a clockwise or counterclockwise direction
- *opposed grasp:* puts four fingers tips together at the end of the thumb
- *pointing radial finger:* curls three fingers toward the palm leaving the forefinger extended in a pointing position
- *release:* with palm down, exaggerates straightening the fingers so that they are as far apart as possible as if to release

a held object

- *full supination:* rotates forearm with palm up

- *crossed fingers*: crosses middle finger over the end of the forefinger

- *pointing ulnar finger:* clenches fingers toward palm while the little finger remains in a pointing position

Unilateral/Bilateral Patterns.

- *unilateral:* the learner does not cross midline of body with right and left arms

- *bilateral mirror movement:* brings two identical hand shapes together at midline in mirrored manner (e.g., both palms are together as in prayer; the hands can move together or apart in mirrored manner)

- *bilateral movement:* uses two different hand shapes or movements; not crossing midline; moving in the same or opposite direction

- *unilateral across midline:* crosses midline of the body or face with one hand

- *bilateral: one hand is stable, the other hand moves:* holds one hand stable, while the other hand moves at midline; the two hand shapes may be the same or different

- *bilateral: both mover:* two different or similar hand shapes at midline both moving

- *bilateral crossing midline with two hands:* moves both hands across the midline of the body or face

Developing Use of Objects for Communication

- *Learner:* when asked if she or he wants to drink, the learner will, with assistance, *touch* a glass of juice to indicate the desire to drink.

Teacher: on the table in front of the learner, display a glass having ½" of juice. Ask "What do you want? Do you want to drink?" If the learner responds affirmatively, continue. Otherwise, terminate the trial. If affirmative, assist the learner to *touch* the glass. As it is *touched*, immediately say "Drink" and

give/assist the learner to drink the juice.

- *Learner:* when asked if he or she wants to drink, the learner will, *with* assistance, *touch* a glass of juice, one of three objects in front of him/her, to indicate the desire to drink.

Teacher: on the table in front of the learner display a glass having ½" of juice and randomly placed on either side, on successive trials, 1 then 2 then 3 distractor objects (*to be used for later communication training, e.g., a small ball ["Want to play?"]; the label from a potato chip bag ["Want a chip?"], or a small bar of soap ["Want toilet?"]*). Ask "What do you want? Do you want a drink?" If the learner responds affirmatively, continue. Otherwise discontinue the trial. If, affirmative, if required, assist the learner to *touch* the glass. As the glass is *touched,* immediately say "Drink" and give/assist the learner to drink the juice. Continue these trials until all 3 distractor objects have been introduced.

- *Learner:* when asked if he or she wants to drink, the learner will, *without* assistance, *touch* a glass of juice, one of three objects in front of him or her to indicate the desire to drink.

Teacher: if the learner still requires assistance to touch the glass, proceed with this step. Otherwise, go to the next step. Present the glass and all of the other objects as above. Ask "What do you want? Do you want to drink?" If the learner responds affirmatively, wait 5 seconds for the learner to touch the glass. If the learner does not touch the glass, assist him/her to *touch* the glass, immediately say "Drink" as the glass is touched and give/assist the learner to drink the juice. Continue the trials until the learner touches without assistance.

- *Learner:* when asked "What do you want?" the learner, if thirsty, will without assistance touch a glass of juice, one of three objects in front of him/her to indicate the desire to drink.

Teacher: when the data indicates that it is probable the learner would like to drink, present the glass and all the other objects as above. Ask *only "What do you want?"* If the learner does not touch the glass after 5 seconds, terminate the trial. If the learner *touches* the glass, immediately say, "Drink" and give/assist the learner to drink. Continue trials until the thirsty learner consistently and promptly touches the glass.

- *Learner:* when asked if she or he wants a chip, the learner will touch a potato chip label to indicate the desire to eat a chip.

Teacher: begin teaching use of one of the other objects for communication (e.g., the potato chip bag label with a potato chip touching the side of the label furthest from the learner). On the table in front of the learner, present the glass with ½" of juice and randomly on either side place the chip label and a chip. Ask "What do you want? Do you want a *CHIP*?" If the learner responds affirmatively, continue. Otherwise terminate the trial. If affirmative, immediately if necessary, prevent the learner from touching the glass, say *CHIP* and assist him/her to *touch* the chip label. As the chip label is *touched*, immediately say *CHIP* and give/assist the learner to eat a chip.

- *Learner:* when asked randomly if she or he wants *either* a chip or a drink, the learner will touch the corresponding glass or label to indicate his or her desire.

Teacher: on successive trials, a) make the chip smaller and smaller until no chip is left and the cue becomes the label rather than the chip; b) say the word *chip* without emphasis; c) if required, temporarily reintroduce the word *DRINK* with emphasis, and d) randomly alternate *drink* and *chip* without emphasis until the learner consistently touches the correct objects, e) introduce the third object, the bar of soap, and f) fade all assistance required to touch the correct object and prevent touching the wrong object.

- *Learner:* when given a communication board on which all the objects that have been taught are mounted, the learner will attract the visual attention of a caregiver, *touch* one of the objects to communicate his or her desire to have that object, person, place or activity.

Teacher: highly reinforce the learner's spontaneous use of the objects on the communication board by immediately providing the touched item. Do not provide any of the persons, places, activities or objects to the learner unless she or he first *touches* the corresponding object on the communication board. Whenever referring in conversation to the actual person, place, activity or object to which the communication objects refer, always *touch* the corresponding object on the learner's communication board.

- *Learner:* perform each of the foregoing tasks after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.).

Developing the Use of Pictures/Photographs for Communication

- *Learner:* when asked "What do you want? Do you want (give the name of a particular person, place, activity or object)?", the learner will select the corresponding *picture (or photograph)* by *touching/tracing* its discriminative features.

Teacher: initially, teach the use of pictures of *highly familiar* and *highly preferred* persons, places, activities or objects (*see Note* below). Use black and white, or color photographs (refer to earlier discussion on using photographs). When the label for an object, person, etc. is presented, *touch* or trace the discriminative features of both the picture and the referent. For example, given a picture of a favorite wind-up toy named *Spinner,* hold the picture next to the actual toy, say *Spinner* and assist the learner to *touch* the spinning red hat and dancing feet. Say "Spinner" and assist the learner to *touch* the hat and feet in the picture. Teach the learner to touch, without assistance, the hat and feet of the picture when you say the name, "Spinner." When the learner touches or traces the appropriate picture, immediately present him/her with the item represented in the picture.

Note: Initially use pictures of favorite food, activities, toys/dolls and preferred staff. Pictures may depict: cookies, popcorn, cereal, sandwich, drink, ball, music, computer, swing, tickle, hug, bounce on the knee, vibrator, video or computer game, music, picture book; busy box having various switch activated lights, sounds, vibrations, fans, colors; responsive toys (dolls, animals) that laugh, cry, talk, squeak, or move when activated; or remote control cars, robots, and animals.

- *Learner:* when asked "What do you want? Do you want ___(e.g., give the name of a second person, place, activity or object, for example *Al*/the name of a favorite toy elephant), the

learner will touch the discriminative features (e.g., trunk and ears) shown in a picture of Alf.

Teacher: use the teaching techniques described above.

- *Learner:* when asked "What do you want? Do you want (randomly present the names of either Alf or Spinner)?", the learner will touch the discriminative features of the corresponding picture of Alf or Spinner when they are randomly presented side-by-side on a communication board.

Teacher: use the teaching procedures described above and immediately present Alf or Spinner to the learner when she or he touches the corresponding picture.

- *Learner:* perform each of the foregoing tasks when presented randomly with questions related to selection of one of *several* pictures of actual persons, places, activities or objects randomly located in various positions on a communication board.

- *Learner:* when asked only "What do you want? Do you want *X* or *Y* (give the names of any two of the previously taught persons, places, activities or objects)?", the learner will touch one of the corresponding pictures on his or her communication board.

Teacher: immediately give the learner the person, place, activity or object represented in the corresponding picture.

- *Learner:* touch one of the previously introduced pictures when asked only, "What do you want?"

Teacher: immediately give the learner the actual persons, places, activities or objects to which the touched picture referred.

- *Learner:* when given a communication board on which all of the pictures that have been taught are mounted, the learner will attract the visual attention of a caregiver and *touch* one of the pictures to communicate his or her desire to have that object, person, place or activity.

Teacher: highly reinforce any spontaneous touching of the pictures by immediately providing the requested item. Do not provide any of the persons, places, activities or objects to the learner unless he or she first *touches* the corresponding picture

on the communication board. Whenever referring in conversation to the actual person, place, activity or object to which the pictures refer, always *touch* the corresponding picture on the learner's communication board.

- *Learner:* perform each of the foregoing tasks after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.).

Using Line-Drawings/ Pictographs for Communication

Figure 15. Line-drawings/ Pictographs

- *Learner:* when presented with *one* line-drawing/ pictograph of a person, place, activity or object (e.g., a computer) on a communication board, and asked the question, "What do you want? *(The question corresponds to the person, place, activity or object depicted in the pictograph presented to the learner).* "Do you want (*to play on the computer*)?" the learner will *touch* the line-drawing/ pictograph corresponding to the pictograph of the person, place, activity or object referred to in question (e.g., the computer).

Teacher: initially assist the learner to touch the pictograph of the computer; later, fade this assistance; when the pictograph is *touched*, immediately say, "Play on the computer" and turn on the computer *monitor* with the game *ready* for play. For this and the following tasks, use the teaching methods described in *Developing Use of Objects for Communication.*

- *Learner:* when presented with *two* (and later with three) pictographs (e.g., a *computer, popcorn* and later a *picture*

book) randomly located in various positions on a communication board, and asked the question, "What do you want? *(The question corresponds to the person, place, activity or object depicted in the pictograph presented to the learner).* Do you want (*to play on the computer*)?" the learner will *touch (the pictograph of the person, place, activity or object referred to in the question)* the pictograph corresponding to the computer.

Teacher: initially assist the learner to touch the pictograph of the computer; later, fade this assistance. When the pictograph is *touched*, immediately say, "Play on the computer" and give the computer to the learner to play with.

Learner: when presented with three pictographs (e.g., a computer, popcorn and a picture book) randomly located in various positions on a communication board, and asked the question, "What do you want? Do you want (*popcorn*)?" the learner will *touch* the pictograph corresponding to the popcorn.

Teacher: initially assist the learner to touch the pictograph of the popcorn; later, fade this assistance. When the pictograph is *touched*, immediately say, "Popcorn" and give two or three pieces of popcorn to the learner to eat.

Learner: when presented with three pictographs (e.g., a computer, popcorn and a picture book) randomly located in various positions on a communication board, and asked, "What do you want? "Do you want (randomly either "to play on the computer" or "popcorn")?", the learner will *touch* as appropriate the pictograph corresponding to the popcorn or the computer.

Teacher: when a pictograph is *touched*, immediately say, "Popcorn" or "Play with the computer," corresponding to the pictograph touched and give the learner either one to three pieces of popcorn or the computer.

- *Learner:* when given a communication board on which all of the pictographs that have been taught are mounted (e.g., a computer, popcorn, picture book, toilet, eat, drink, rest, stop, Yes, No, etc.) the learner will attract a caregiver's attention and touch one of the pictographs to communicate his or her desire to have the object, activity, person or place indicated.

Teacher: do not provide any of the persons, places, activities or

objects depicted on the communication board until the learner *touches* the corresponding pictograph. When a pictograph has been touched, immediately provide that item to the learner. During conversation, whenever referring to one of the items depicted on the communication board, touch the corresponding pictograph.

Other Activities Related to Pictograph Communication

- the learner matches pictograph to object (e.g., match a pictograph of a chair to an actual chair)
- given the verbal *name* of an object (e.g., *dog*), select the corresponding pictograph
- given an actual person performing an *verb/action* (e.g., *jump*), match to the pictograph representing that action
- given a pictograph representing an action (e.g., *stand*), match to an actual person performing that action
- given a spoken verb (e.g., *throw*), find the pictograph representing that verb
- given a pictograph representing a verb/action (e.g., *sit*), perform the action
- given a pictograph representing an adjective (e.g., *a happy face*), match with an actual person having that attribute
- given a spoken *adjective* (e.g., *round*), find the line-drawing, pictograph that represents that adjective
- find random examples in the surrounding environment of the noun, verb or adjective, represented by the line-drawing/pictograph
- make the foregoing matches and functional communicative uses of the line-drawings/pictographs after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Miniature Representations for Communication

Teacher: follow the teaching procedures described for

Other Activities Related to Communicating with Miniatures

- the learner matches a real object to a miniature representation of the object
- match a miniature representation of an object to the real object
- given the verbal name of an object, match with the miniature representation of the object
- find random examples in the surrounding environment of an object (e.g., shoe, represented by a miniature representation of the object)
- self-initiate use of a miniature representations to communicate in a functional situations (e.g., draw a converser's attention to a miniature representation of *bed* to indicate being tired)
- make the matches and functional communicative uses of miniature representations after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Blissymbols for Communication

BLISSYMBOLS

TEACHER ANIMAL CAR

Figure 16. Blissymbols

- *Learner:* when presented with a single *Blissymbol* (e.g., CD player) on a communication board, and asked the question, "What do you want? Do you want (to listen to the Bee Gees)?" the learner will *touch* the Blissymbol corresponding to the CD player.

Teacher: initially assist the learner to touch the symbol of the CD player; later, fade this assistance; when the symbol is *touched,* immediately say, "Listen to the Bee Gees" and turn on the CD recording of the Bee Gees; for this and the following tasks, use the teaching methods described in *Developing Use of Objects for Communication.*

Learner: when presented with *two* (and later with three) Blissymbols (e.g., a *CD player, eat* and *drink*) randomly located in various positions on a communication board, and asked the question, "What do you want? Do you want (to listen to the Bee Gees)?" the learner will *touch* the symbol corresponding to the CD player.

Teacher: initially assist the learner to touch the symbol of the CD player; later, fade this assistance. When the symbol is *touched,* immediately say, "Listen to the Bee Gees" and turn on the CD recording of the Bee Gees

Learner: when presented with three Blissymbols (e.g., a *CD player, eat* and *drink*) randomly located in various positions on a communication board, and asked the question, "What do you want? Do you want ___ (to eat)?" the learner will *touch* the symbol corresponding to *eat.*

Teacher: teach at a time when it is likely the learner will be hungry; initially assist the learner to touch the symbol for *eat;* later, fade this assistance. When the symbol is *touched,* immediately say, "Eat" and give to the learner two or three pieces of cereal, raisins, apple, banana or a bite-size piece of a sandwich.

Learner: when presented with three Blissymbols (e.g., a CD player, *eat* and *drink*) randomly located in various positions on a communication board and asked, "What do you want? Do you want ___ (randomly either "to listen to the Bee Gees" or "eat")?" the learner will *touch* the pictograph corresponding to either the CD player or *eat.*

Teacher: when a symbol is *touched,* immediately say, "Listen to the Bee Gees" or "Eat," corresponding to the symbol touched and give the learner either two or three pieces of food or turn on the CD recording of the Bee Gees.

- *Learner:* when given a communication board on which all of the Blissymbols that have been taught are mounted (e.g., CD player, *eat, toilet, drink, rest, stop, Yes, No,* etc.) the learner will attract a caregiver's attention and touch one of the symbols to communicate his or her desire to have the object, activity, person or place indicated.

Teacher: do not provide any of the persons, places, activities or objects depicted on the communication board until the learner *touches* the corresponding Blissymbol. When a symbol has been touched, immediately provide that item to the learner. During conversation, whenever referring to one of the items depicted on the communication board, touch the corresponding symbol.

Other Activities Related to Using Blissymbols

- the learner matches an actual person, place, activity or thing to the corresponding Bliss Symbol
- match Blissymbols representing a person, place or thing to the actual person, place or thing
- given the verbal label of an object, select the Blissymbol of the object
- given a person performing an action, match to the Blissymbol representing that action
- given a Blissymbol representing an action, match to a person performing that action
- given a spoken verb, find the Blissymbol representing the verb
- given a Blissymbol representing an action, perform the action
- self-initiate use of Blissymbols to communicate in a functional situations (e.g., draw a converser's attention to a Blissymbol of *toilet* to indicate needs)
- make the matches and functional communicative uses of the Blissymbols after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Parts of Objects for Communication

Teacher: follow the teacher procedures described for *Developing Use of Objects for Communication*

Other Activities Related to Communication Using Parts of Objects

- the learner, given a whole object (e.g., a shoe, find the parts of the object (e.g., a short piece of shoe lace) used to represent the object)
- given parts of an object used to represent a whole object, match to the whole object
- given the verbal label of an object, match to the corresponding part of the object used to represent the whole object
- self-initiate use of parts of objects to communicate in functional situations (e.g., draw a converser's attention to a part of an object, such as a section of a TV schedule to indicate the desire to watch TV)
- make the matches and functional communicative uses of parts of objects used to represent whole objects after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Textured Materials for Communication

Teacher: follow the teacher procedures described for *Developing Use of Objects for Communication*

Other Activities Related to Using Textured Material for Communication

- the learner matches an actual person, place or thing (e.g., bearded John) to textured material (e.g., a small piece of fur) representing that thing
- given a textured symbol (e.g., Velcro) used to represent a person, place or thing (e.g., *wet pants*), find the condition
- given the verbal name of a person, place or thing, match to the corresponding textured material
- given a person performing an action (e.g., sealing envelopes),

match to the textured material (e.g., a piece of sticky tape) representing the action

- given a textured symbol to represent a verb/action (e.g., a piece of terry towel to represent washing one's face), perform the action

- given a spoken verb (e.g., *find*) match with the textured material that represents the verb (e.g., a pot of sand in which things are buried)

- given a textured symbol representing an action (e.g., *pour*), perform the action

- given a textured symbol to represent an *adjective* (e.g., a piece of silk to represent *smooth*), match with something smooth (e.g., a smooth piece of sanded wood)

- given an adjectival label (e.g, *cold*), match with a textured symbol representing that adjective (e.g, a small piece of polished chrome)

- self-initiate use of textured symbols to communicate in a functional situation (e.g., draw a converser's attention to barley flakes to communicate thirst)

- make the matches and functional communicative uses of textured symbols after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Product Logos or Labels for Communication

Teacher: follow the teaching procedures described for *Developing Use of Objects for Communication*

Other Activities Related to Communicating with Product Logos or Labels

- the learner matches an actual object, (e.g., bowl of tomato soup), to a product logo or label corresponding to the object (e.g., a label from a can of Campbell's tomato soup)

- given a product logo or label (e.g., label from music CDs) match to actual CDs

- given the verbal name of an object, match with the

corresponding product logo or label

- self-initiate use of product logos or labels to communicate in a functional situation, e.g., draw a converser's attention to a Heinz Ketchup label to indicate wanting ketchup on one's chips

- make the foregoing matches and functional communicative uses of product logos/labels after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Printed Words for Communication

Teacher: follow the teaching procedures described for *Developing Use of Objects for Communication*

Other Activities Related to Communication with Printed Words

- the learner, given a person, place, activity or thing, matchs to the corresponding printed word

- given an object, picture or pictogram of a person, place, activity or thing match to the corresponding printed word

- given a printed word representing a person, place, activity or thing, match with the corresponding object, picture or pictogram

- given a printed word representing a person, place or thing, match to the actual person, place or thing

- given a verbal name of a person, place, activity or thing, match to the corresponding printed word

- given a printed word representing a person, place, activity or thing, read the word

- given a person performing an action, match the printed word representing that action

- given a printed word representing an action, match to the person performing that action

- given an object, picture or pictograph of a person performing an action, match to the corresponding printed word

- given a printed word representing a verb, match with a corresponding photograph, pictograph, picture or person

representing the action

- given a spoken verb, find the printed word representing that action

- given a printed word representing a verb, read the verb

- given a printed word representing an action, perform the action

- given an adjectival condition, match with the corresponding printed word

- given a printed word representing an adjective, match with the corresponding photograph, pictograph, person or picture representing the adjective

- given a photograph, pictograph, person or picture representing an adjective, match with the printed word representing that adjective

- given a spoken adjective, find the printed word representing the adjective

- given a printed word representing an adjective, read the adjective

- given a printed word representing an adjective (e.g., *red*) make something red (e.g., color the ball red)

- find random examples in the surrounding environment of the nouns, verbs or adjectives represented by the printed word

- self-initiate use of printed words to communicate in a functional situation:
a) for example, draw a converser's attention to a verbal word, such as *cookie* indicating the wish to have a cookie, or
b) read a printed word such a drink to communicate one's desire to have a drink

- make the foregoing matches and functional communicative uses of words after successively longer periods of time following the end of instruction (e.g., after 10, 20, 40, 90 minutes; 2, 4, 8, 24, 48 hours; 3, 5, 9, 15, 30 days, etc.)

Using Communication Boards for Communication

- the learner demonstrates sufficient muscular control for accurate pointing, touching or gazing at symbols mounted on a

communication board

- obtains converser's attention before selecting a symbol or picture

- uses systematic scanning and analysis of pictures and symbols (e.g., scans from left-to-right and up-to-down; or locates category and systematically searches within a category)

- locates caregiver named pictures and symbols even when they are rearranged on a communication board

- continues to effectively search and select caregiver named pictures as additional pictures/ symbols are added to the communication board (e.g., 1-5; 6-10; 11-15+)

- uses one set of graphics in one situation (e.g., pictures related to ordering food), and another set in a different situation (e.g., a workshop environment)

- uses a reliable method for indicating which symbol has been chosen (e.g., pointing, touching or gazing with a head pointer or head stick, etc.)

- points, touches or gazes with a head pointer or head stick at a symbol/picture long enough so that converser can determine which symbol has been selected

- responds rapidly enough in selection of symbols and pictures to maintain the interest and comprehension of a cooperative converser (adult or peer) or an unfamiliar converser (a stranger)

- understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you pointed to." Shrugs his or her shoulders and/or raises hands palms up in front of chest)

- uses correction procedures when a converser indicates that the message has not been understood (e.g., repeats selection of the same series of symbols/ pictures; selects one or more different items; confirms that the converser sees each item selected; for each item, confirms what the converser understands) (see section on *Conversational Repairs*)

- takes turns in conversations (e.g., knows when it is his or her turn to *talk*; alternates with the converser) (see the section on *Conversational Turn-Taking*)

Using E-Tran Eye-Pointing

- the learner demonstrates sufficient muscular control for accurate and sustained gazing at symbols mounted on the E-Tran board

- secures the attention of a converser before selecting symbols /pictures

- insures that the converser is in position to observer learner's gaze at communication items (symbols, pictures, words, etc.) on the E-Tran board

- uses systematic scanning and analysis of pictures and symbols (e.g., scans from left-to-right and an up-to-down; or locates category and systematically searches within a category)

- locates pictures and symbols even when they are rearranged on the E-Tran board

- continues to effectively scan and select caregiver named pictures as additional pictures/ symbols are added to the board (e.g., 1-5; 6-10; 11-15+)

- uses one set of graphics in one situation (e.g., pictures related to ordering food), and another set in a different situation (e.g., a workshop environment)

- to communicate a word, phrase or sentence, the learner gazes steadily, in sequence, for 2-3 seconds at each of one or more communication items on the frame

- when the communication items have been selected, the learner looks at the converser for confirmation

- the learner then attends to the converser as he or she points in sequence to the communication items or says the word, phrase or sentence the conserver thinks was communicated

- the learner then makes a prearranged response to indicate the interpretation was correct or incorrect

- understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you pointed to." Shrugs his or her shoulders and/or raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats the

sequence (see *Conversational Repairs*)

SCANNING AND SELECTION OF DISPLAYED COMMUNICATION ITEMS (OBJECTS, PICTURES OR SYMBOLS)

Piche and Reichle (1991) provide detailed description of methods used to teach the various types of scanning described below.

Direct Selection

This method is used when a learner, given a graphic communication system, directly touches or points to a symbol, picture or object. Touching may involve any part of the body, such as using a directed gaze, using a pointer or using a head stick. Direct selection is preferred over other types of scanning because it usually requires less time and is more efficient. In addition, the various methods of scanning listed below, generally require more learning than is involved in direct selection.

Visual Scanning and Direct Selection

The following references were used as information sources for this discussion: Blischak, Loncke, Waller (1997); Mustonen, Locke, Reichle, Solbrack and Lindgren, (1991); Piche and Reichle (1991); Wasson, Arvidson, and Lloyd (1997).

This technique involves systematically moving one's visual attention across an array of objects, words, or symbols in search of a *target item* randomly located in the array, visually fixating on the target item when located, and/or pointing to or touching the target item. The items may be systematically organized into columns and rows, or they may be randomly placed. The items may be objects located on a table, pictures or symbols located on a communication board, or people/objects located in a larger environment such as a classroom or playing field

When asked: "Where is ___?" "Find___." "Point to ___." "Show me ___." "Touch___ with finger or head-pointer" and/or "Look at ___(fixated eye-gaze)." etc. an item randomly located in a

row or rows, the learner will:

- systematically scan 1-5, 6-10 items from left to right
- systematically scan 1-5, 6-10 items in a vertical column
- systematically scan 1, 2, 3, 4, 5-10 rows of 2, 3, 4, 5-10 items each, left to right, top to bottom,
- given two or more separate sets of objects, scan one set before scanning the next
- scan randomly placed items, located near and far (e.g., people or objects in the natural environment, classroom or football field)
- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

Auditory Scanning and Converser Assisted Selection

This procedure is used when a learner is unable to directly select a symbol, picture or object because of lack of sufficient motor control, or when a specific vocabulary item is not available among a display of symbols, pictures or objects. The converser orally lists a menu of alternative responses to the learner. For example, after the converser asks, "What do you want?" or "Where do you want to go?", he or she lists alternatives (e.g., "To the cafeteria?" "To the gym?" "To the woodworking shop?"). When the converser states the desired selection, the learner gives a prearranged signal (e.g., blinks eyes, nods, or uses a switch) to express his or her desire. Note: during the operations listed below, when the learner makes the various prearranged signal to indicate: item selection, an error, a new list of items, etc., the prearranged signals should be easily discriminable from other responses the learner makes.

- the learner listens as the converser, orally lists the response alternatives, when there are 2, 3, 4, 5 and 6+ alternatives
- learner uses a prearranged signal (e.g., blinks eyes, nods, or uses a switch to make a response) to indicate when the converser states the desired alternative, when successive items are stated with a 4, 3, 2 or 1 second pause between items

- makes the prearranged signal only when the desired response is listed; does not use the signal at any other time

- makes the prearranged signal 4, 3, 2 or 1 second after the desired alternative is stated

- when the learner has made an incorrect selection or wishes immediately to change the alternative selected, the learner will use another prearranged signal to indicate re-selection is required (e.g., shakes head, makes sound, or uses switch)

- when the learner wishes to review the list of response alternatives, uses a prearranged signal to indicate re-selection

- when the desired alternative was not listed by the converser, the learner uses a prearranged signal to indicate that a new list of alternatives should be provided rather than review the previous listing

Visual Scanning and Converser Assisted Selection

This technique is used with learners unable to point to, touch, fixate gaze or head-point to targets in an array. A converser points sequentially to each of a series of objects, pictures or symbols in a display; the learner signals to stop when the target communication item is pointed to.

- the learner, when asked a question, such as "Where is the ___." "What do you want?", the learner visually attends as a converser points to successive items (pictures, symbols, objects) in an array, one of which will answer the question, when there are 1-5; 6-10, and 11-15+ items in the array

- uses a prearranged signal (blinks eyes, nods, or uses a switch to make a response) to indicate when the converser points to the item that will answer the question, when successive items are pointed to after a 5, 4, 3, 2 or 1 second pause between

- makes the prearranged signal 4, 3, 2 or 1 second after the desired alternative is pointed to

- makes the prearranged signal only when the desired response is pointed to; does not use the signal at any other time

- when the learner has made an incorrect selection or wishes immediately to change the alternative selected, the learner will use another prearranged signal to indicate re-selection is

required (e.g., shakes head, or makes sound)

- when the learner wishes to review the list of response alternatives, uses a prearranged signal to indicate re-selection

- when the desired alternative was not pointed to by the converser, the learner uses a prearranged signal to indicate that a new list of alternatives should be provided rather than reviewing the previous listing

Electronic Scanning

An electronic scanner systematically highlights successive items in a display, one item at a time; when the target item is highlighted, the learner uses a prearranged signal (blinks eyes, nods or uses a switch to make a response) to indicate that the target item is highlighted.

USING SWITCHES IN COMMUNICATION

Step Element Scanning

This method requires the learner repeatedly to activate the switch to advance the cursor one *communication item* (e.g., symbol, picture or word) for each activation (Mustonen, Locke, Reichle, Solbrack & Lindgren, 1991).

- the learner, when wishing to communicate, first focusses the converser's attention on the communication display

- provides the right type and amount of force to activate the switch to move the cursor to the first *item* in the communication display

- determines if the *item* represents the idea he or she wishes to communicate (e.g., recalls the nature of the item that represents the idea to be communicated, then discriminates that item from other similar items in the display

- when the cursor has not stopped at the target item, the learner reactivates the switch to progress to the next item

- learner continues to activate and stop the switch, progressing from item to item until the target item is reached

- when the cursor has stopped at the target item, the learner gives some prearranged signal to indicate that the target item

has been reached (e.g., makes a sound, blinks eyes, and/or nods head)

- if the learner gives a silent signal, he or she first assures that the converser's attention has been drawn to him/her so that the signal will be seen

- the learner then waits for a prearranged signal from the converser that the communication has been understood

- the learner then selects the next item in the message until she or he indicates with some prearranged signal that the message is complete

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the learner, when making an incorrect selection or wishing immediately to change a selection, will use another prearranged signal to indicate re-selection is required (e.g., shakes head, or makes sound)

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see that." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Automatic Scanning

This method requires the learner to activate a switch to start continuous cursor movement that stops only when the switch is again touched when the cursor has arrived at the *target communication item*. The switch must be reactivated to find the next symbol (Mustonen, Locke, Reichle, Solbrack & Lindgren, 1991)

- the learner, when wishing to communicate, first focusses the converser's attention on the communication display

- provides the right type and amount of force to activate continuous movement of the cursor to each successive item in the communication display

- attends closely to each successive item the cursor approaches

to determines if the item the cursor is about to touch is the target item (e.g., the learner must recall the nature of the item that represents the idea to be communicated, and then must discriminate that item from other similar items in the display)

- when the cursor has moved to the target item, the learner deactivates the switch to stop the cursor on the target item (e.g., requires the learner's anticipation of the cursor touching the target item, and requires deactivating the switch at the correct time, neither too early nor too late)

- if the cursor is stopped too early or too late, the learner gives a prearranged signal to indicate an error has been made (e.g., makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to the learner so that the signal will be seen

- the switch is reactivated until the cursor has been stopped on the target item

- when the cursor has stopped at the target item, the learner gives some prearranged signal to indicate that the target item has been reached

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the learner then waits for a prearranged signal from the converser to indicate that the communication has/has not been understood

- the learner may then select the next item in his message until she or he indicates with some prearranged signal that the message is complete

- the converser may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see that." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Inverse Scanning

This approach requires a learner to make continuous contact with the switch to move the cursor; the cursor stops when the learner releases the switch. (Mustonen, Locke, Reichle, Solbrack & Lindgren, 1991)

- the learner when wishing to communicate, first focusses the converser's attention on the communication display

- learner provides the right type and amount of force to activate movement of the cursor

- continues to apply the same amount and type of force to keep the cursor moving from communication item to item

- attends closely to each successive item the cursor approaches

- learner determines if the next item the cursor is about to touch is the target item (e.g., must recall the nature of the item that represents the idea to be communicated, then must discriminate that item from other similar items in the display)

- when the cursor has moved to the target item, the learner releases pressure on the switch to stop the cursor on the target item (e.g., requires anticipating the cursor touching the target item, and releasing pressure on the cursor at the correct time, neither too early nor too late)

- if the cursor is stopped too early or too late, the learner gives a prearranged signal to indicate an error has been made (e.g., makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to the learner so that the signal will be seen

- the switch is reactivated and continuous pressure is applied until the cursor has been stopped on the target item

- when the cursor has stopped at the target item, the learner gives some prearranged signal to indicate that the target item has been reached

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the learner then waits for a prearranged signal from the

converser that the communication has been understood

- the learner may then select the next item in his message until she or he indicates with some prearranged signal that the message is complete

- the converser may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you selected." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Circular Electronic Scanning

This approach requires a user or converser to activate a switch to move the cursor from item to item, in a clockwise or counterclockwise direction around a circular, clock-like display of communication items. The switch is deactivated to stop the cursor on a target item. Alternatively rather than deactivating the switch, the user may simply give a prearranged signal to indicate that the target item has been reached.

- the learner or the converser activates the scanning process

- the learner attends to each successive item highlighted as the electronic scanner moves in a clockwise or counterclockwise manner around a circular display of words, pictures, objects or symbols highlighting items in the display, one item at a time

- when the target item is highlighted, the learner uses a prearranged signal (blinks eyes, nods or uses a switch to make a response (e.g., ring a bell or shuts off the scanner) to indicate that the target item is highlighted, when successive items are highlighted after a 5, 4, 3, 2 or 1 second pause between

- if the learner fails to make the prearranged signal when the targeted item is highlighted, he or she will wait until the electronic scanner starts to scan the array again and returns to the target item

- if the learner makes an incorrect selection, he or she gives a prearranged signal to indicate an error has been made (e.g.,

makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to him or her so that the signal will be seen

- the switch is reactivated until the cursor has been stopped on the correct item

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the converser may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you selected." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Linear Electronic Scanning

This approach requires a user or converser to activate a switch to move the cursor from item to item, across each successive row, moving from top to bottom in a display. The switch is deactivated to stop the cursor on a target item; alternatively rather than deactivating the switch, the user may simply give a prearranged signal to indicate that the target item has been reached.

- the learner or the converser activates the scanning process

- the learner visually attends as the electronic scanner successively highlights the array of words, pictures, objects or symbols one item at a time, from left to right, across row one, then from left to right across row two and down the array

- when the target item is highlighted, the learner uses a prearranged signal (blinks eyes, nods or uses a switch to make a response e.g., ring a bell or shuts off the scanner) to indicate that the target item is highlighted, when successive items are highlighted after a 5, 4, 3, 2 or 1 second pause between

- if the learner fails to make the prearranged signal when the

target item is highlighted, he or she will wait until the electronic scanner starts to scan the array again and returns to the target item

- if the learner makes an incorrect selection, he or she gives a prearranged signal to indicate an error has been made (e.g., makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to him/her so that the signal will be seen

- the switch is reactivated until the cursor has been stopped on the correct item

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the converser may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you selected." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Row and Column Electronic Scanning

With this method, the scanner moves *down the display* successively highlighting each row of symbols, words or pictures. When the row is highlighted in which a target item is displayed, the scanner, when signalled, sequentially scans *across the display* highlighting each item in the row until the target item is reached and the user indicates stop

- the learner must know where in the array the target item is located before the electronic scanning begins. This knowledge may be assessed by using the *Manual Visual Scanning Procedure* described above in which a converser points to each successive item in an array. When the converser points to the target item, the learner makes a predetermined response to indicate that the target item has been selected

- the learner or the converser activates the scanning process

- the learner visually attends to the scanner as it begins at the top-left corner of an array of words, objects, symbols or pictures and scans down the left side of the array, highlighting each horizontal row in sequence as successive rows are highlighted with a 5, 4, 3, 2 or 1 second pause between

- as each row is highlighted, the learner must quickly scan all items in the row to determine if the target item is displayed in the row

- alternatively, the learner may be able to briefly scan the array of 4, 6, 8, 10, or more items to find the target item before the row and column scanning begins

- when the row in which the target item is located is highlighted, the learner uses a prearranged signal (blinks eyes, nods, uses a switch to make a response, e.g, ring a bell or redirect the scanner along the row

- the learner then attends as the electronic scanner highlights each successive item in the row, one item at a time with a 5, 4, 3, 2 or 1 second pause between

- the learner makes a predetermined response to indicate when the target item is highlighted

- if the learner makes an incorrect selection, he or she gives a prearranged signal to indicate an error has been made (e.g., makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to him/her so that the signal will be seen

- the switch is reactivated until the cursor has been stopped on the correct item

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the converser may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you selected." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Category/Page-Item Electronic Scanning

With this method, communication items may be categorically organized according to:

a) environments (e.g., school, home, vocational site, toilet, cafeteria);
b) topics (e.g., toys, food, activities);
c) parts of speech (e.g, nouns, verbs, adjectives).

These various classifications may be listed on one page, while each specific group is listed on separate pages.

Users of the communication system first select the relevant category and then, the specific communication item in that category.

- the learner must know in which category (e.g., *Semantic:* food or animal, or *Environmental:* kitchen or toilet or *Activity:* work, eat, play) the target item is located before the electronic scanning begins. This knowledge may be assessed by using the *Manual Visual Scanning Procedure* described above in which a converser points to each successive category in the array. When he or she points to the category in which the target item is located, the learner makes a predetermined response to indicate that the target item has been selected

- the learner or the converser activates the scanning process

- the learner visually attends as the scanner highlights each successive category (e.g., home, school, workshop and community) until the category in which the target word is located is highlighted

- when the category in which the target item is located is highlighted, the learner uses a prearranged signal (blinks eyes, nods, uses a switch to make a response, e.g., ring a bell or shut off the scanner, when successive items are highlighted after a 5, 4, 3, 2 or 1 second pause between

- the learner then attends as the electronic scanner highlights each successive item in the category, one item at a time

- the learner makes a predetermined response to indicate when the target item is highlighted

- if the learner makes an incorrect selection, he or she gives a prearranged signal to indicate an error has been made (e.g., makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to him/her so that the signal will be seen

- the switch is reactivated until the cursor has been stopped on the correct item

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the listener may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you pointed to." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the listener's interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

Directed Electronic Scanning

This method requires a learner to move a joystick up or down, left or right, or diagonally to move a cursor in a corresponding direction across a display of communication items. When the target item has been reached, the user stops movement of the joystick to rest the cursor on the item.

- the learner, given an array of words, objects, symbols or pictures, operates a joystick to move a cursor up/down, left/right or diagonally to locate a target item

- the learner may move the cursor directly to the target item, or systematically scan with the cursor until the target item is reached

- when the target item has been passed, the learner can make a corrective return to the target item

- when the target item is reached with the cursor, the learner, rests the cursor on the item and makes some prearranged response to indicate that the target item has been reached

- if the learner makes an incorrect selection, he or she gives a prearranged signal to indicate an error has been made (e.g., makes a sound, blinks eyes, and/or shakes head); if a silent signal is given, the learner first assures that the converser's attention has been drawn to him/her so that the signal will be seen

- the switch is reactivated until the cursor has been stopped on the correct item

- the learner makes the selection of communication items in a sufficiently rapid and accurate manner to hold a converser's attention and comprehension

- the converser may then ask for clarification, take his or her turn in the conversation or terminate the discussion

- understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you pointed to." Shrugs his or her shoulders and raises hands palms up in front of chest)

- if the interpretation was incorrect, the learner repeats or otherwise repairs the sequence (see *Conversational Repairs*)

TACTILE COMMUNICATION WITH DEAFBLIND LEARNERS

(adapted from Jones, 1988)

- Sit down: the learner sits down when patted on the bottom and/or when a caregiver presses down firmly on his or her shoulders

- Stand up: the learner stands up when a caregiver gently pulls up under the learner's arm pits

- Lie down: the learner lies down when a caregiver firmly rubs down the learner's back from shoulders to buttocks

- Eat: the learner eats when a caregiver taps the learner's mouth and traces a finger down the learner's throat

- Drink: the learner drinks when a caregiver shapes the learner's hand as if grasping a glass and touches the learner's

thumb against his or her bottom lip

- Shirt/coat/jacket off: the learner removes her or his shirt/jacket/coat when a caregiver rubs the learner's hand down her or his shirt buttons/ jacket zipper and lifts up on the shoulders of the shirt/jacket

- Shirt/coat/jacket on: the learner puts her or his shirt/jacket/coat on when a caregiver rubs a shirt/coat/jacket against the learner's chest and gives the collar and the open front of the garment to the learner

- Pants off: the learner remove his or her pants when a caregiver rubs the learner's hands down the learner's pant leg, and pushes down on the waist band

- Pants on: the learner puts on her or his pants when a caregiver rubs pants against the learner's legs, and gives the waistband to the learner

- Shoes/socks off: the learner removes his or her shoes/socks when a caregiver taps the bottom of a learner's feet and pulls down on the top edge of the shoes/socks

- Shoes/socks on: the learner puts her or his shoes/socks on when a caregiver taps the bottom of the learner's foot and gives him/her shoes/socks

SPEECH SOUNDS

Adapted from Crockett, Jones, Jordan, Pickett, Shea, Blevins, Wheeler, and Lapierre (1995). The sounds are depicted using standard dictionary pronunciation symbols such as ə as in b*a*nan*a* and ä as in c*a*rt. Wherever possible, examples of each sound are provided in the initial, medial and final positions of words. The sounds are listed in order of the typical age of emergence (indicated in brackets).

Learner makes the following sounds in isolation and/or in combinations with other speech sounds.

- **ä** as in *a*rm, f*a*ther, c*a*r (1- 6 mos.); lips neutral; jaw open

- **o͞o** as in *oo*ze, b*oo*t, t*o* (1-12 mos.); lips rounded and slightly open; jaw slightly open

- **oo** medial only: c*ou*ld, w*ou*ld (1-12 mos.); lips rounded and

slightly open; jaw closed

- **ō** as in: *o*nly, h*o*me, g*o* (1-12 mos.); lips rounded and slightly open; jaw mid-closed

- **ô** as in: l*aw*, c*au*ght, s*aw* (1-12 mos.); lips rounded and slightly protruded; jaw open

- **o** initial and medial only: n*o*t, t*o*p (1-12 mos.); lips slightly rounded and protruded; jaw open

- **ē** as in: *ee*l, r*ea*l, w*e* (1-12 mos.); lips spread; jaw almost closed

- **i** as in: *i*f, p*i*g, pretty (1-12 mos.); lips spread; jaw almost closed

- **e** initial and medial only: *e*nd, b*e*d (1-12 mos.); lips neutral; jaw mid-closed

- **a** initial and medial only: *a*s, c*a*n (1-12 mos.); lips neutral; jaw open

- **u** as in *u*p, c*u*p, banan*a* (1-12 mos.); lips neutral; jaw mid-closed

- **ā** as in: *a*te, t*a*ke, pl*ay* (1-12 mos.); lips move from open to almost closed; jaw moves from mid-closed to almost open

- **ī** as in: *I*, l*i*ke, b*y* (1-12 mos.); lips neutral to neutrally spread; jaw moves from open to almost closed

- **ou** as in: *ou*t, l*ou*d, c*ow* (1-12 mos.); lips move neutral to rounded position; jaw moves from open to slightly open

- **oi** as in: *oi*l, v*oi*ce, b*oy* (1-12 mos.); lips move from slightly rounded to neutrally spread; jaw moves from open to almost closed

- **joo** as *u*se, c*u*te, f*ew* (1-3 years); lips spread; jaw almost closed

- **h** initial and medial only: *h*e, a*h*ead (1-3 years); takes on the appearance of the vowel that follows

- **hw** initial and medial only: *wh*en, some*wh*ere (1-3 years); lips rounded and protruded; vowel that follows influences appearance

- **w** initial and medial only: *w*all, a*w*ake (1-3 years); lips rounded and protruding; vowel that follows influences

appearance

- **p** as in *p*ut, ra*p*id, ma*p* (1-3 years); lips closed, then opened to expel air

- **b** as in: *b*e, a*b*out, jo*b* (1-3 years); lips closed, then opened to expel air

- **m** as in: *m*an, li*m*it, a*m* (1-3 years); lips closed, then opened to expel air

- **n** as in: *n*o, a*n*y, ti*n* (1-3 years); tip of tongue touching alveolar ridge; tongue placement may be visible especially when the sound is produced with central vowels

- **d** as in: *d*o, A*d*am, ha*d* (2-4 years); tip of tongue touching alveolar ridge; tongue placement may be visible especially when sound is produced with central vowels

- **k** as in: *c*an, ma*k*e, loo*k* (2-4 years); limited visual information; lips open; jaw mid-closed

- **g** as in: *g*o, wa*g*on, do*g* (2-4 years); limited visual information; lips open; jaw mid-closed

- **t** as in: *t*o, au*t*o, i*t* (2-6 years); tip of tongue touching alveolar ridge; tongue placement may be visible especially when sound is produced with central vowels

- **ng** medial and final only: fi*ng*er, lo*ng* (2-6 years); limited visual information; lips open; jaw mid-closed

- **y** initial and final only: *y*ellow, can*y*on (2.5-4 years); not easily identified; lips apart and pulled back slightly

- **f** as in: *ph*one, co*ff*ee, i*f* (2.5-4 years); the upper front teeth rest on the lower lip

- **ir** as in: *ear*th, c*url*, st*ir* (3-6 years); lips slightly rounded; jaw mid-closed

- **l** as in *l*ike, co*l*or, bow*l* (3-6 years); tip of tongue movement to the alveolar ridge may be visible

- **r** as in: *r*ow, o*r*al, ba*r* (3-6 years); lips rounded and protruding; the vowel that follows influences appearance

- **sh** as in: *sh*e, di*sh*es, wa*sh* (3.5-7 years); lips almost closed depending on neighbouring vowels

- **s** as in: *s*ee, la*c*y, bu*s* (3-8 years); tip of tongue touching

alveolar ridge; tongue placement may be visible especially when sound is made with central vowels

- **z** as in: *z*oo, ea*s*y, wa*s* (3-8 years); tip of tongue touching alveolar ridge; tongue placement may be visible especially when sound is made with central vowels

- **v** as in: *v*ine, ne*v*er, ha*v*e (4-8 years); the upper front teeth rest on the lower lip

- **th** as in: *th*in, no*th*ing, too*th* (4.5-7 years); tongue tip visible between front teeth; lips spread slightly

- ***th*** as in: *th*e, bo*th*er, ba*th*e (4.5-7 years); tongue tip visible between front teeth; lips spread slightly

- **ch** as in: *ch*air, tea*ch*er, cat*ch* (3.5-7 years); lips rounded and protruding; blade of tongue raised and visible through slightly open teeth

- **j** as in: *j*am, en*j*oy, led*g*e (4-7 years); lips rounded and protruding; blade of tongue raised and visible through slightly open teeth

- **zh** medial and final only: vi*s*ion, bei*g*e (6-8.5 years); lips almost closed depending on neighbouring vowels

EARLY LANGUAGE DEVELOPMENT
(adapted from Gard, Gilman and Gorman, 1993; McCormick, 1997)

- the learner understands "No!" and withdraws appropriately (6-9 mos)

- extends arm to be lifted (9-12 mos.)

- reaches to request object (9-12 mos)

- gives block, toy or object on request (9-12 mos)

- turns head to own name (9-12 mos)

- shows and offers objects to *request* social interaction (12-18mos)

- hands book to an adult to *request* a story (12-18 mos)

- brings mechanical toy to adult for activation (12-18 mos)

- pulls adult to location to *request* attention to an object (12-18

mos)

- requests by pointing and vocalizing (12-18 mos)
- uses gestures such as pointing to direct adult attention (12-18 mos)
- most vowels and consonants produced, creating meaningless sounds (12-18 mos)
- approximately 70% intelligible: may omit final consonants, simplify consonant blends, substitute one consonant for another (24 -30 mos)
- approximately 80% intelligible: uses p, b, n, w and h (24-30 mos)
- uses final consonants most of the time (36-40 mos)
- can use *b, d, k, g, f* and *y* in all contexts (40-48 mos)
- can use *th, sh, ch* and *j* in all contexts (72-84mos)
- follows simple one step command (12-18 mos)
- follows simple two step command (18-24 mos)
- follows three step command (40-48 mos)
- uses 10 words for favorite toys, foods, drinks, clothing, family members or pets (cup, bottle, mama, doggie, ball); uses these words for naming, requesting, commenting, and inquiring (13 -15 mos)
- uses two word combinations (12-18 mos)
- uses words to request desired object and events (18-24 mos)
- names objects spontaneously in the presence of others (18-24 mos)
- uses turn-taking in play (4-8 mos)
- begins verbal turn-taking (18-24 mos)
- sustains topic for one or two turns (24-36 mos)
- primary strategy for maintaining a topic is repeating part or all of the utterance produced by partner (30-36 mos)
- speaks in three to four word combinations (18-24 mos)
- deliberate imitation of movements and vocalizations (4-8 mos)

- imitates some words accurately (12-16 mos)
- uses names of most familiar objects (18-24 mos)
- combines two words into phrases (18-24 mos)
- uses 4-7 word sentences (48-54 mos)
- speaks in 5-8 word sentences (54-60mos)
- responds appropriately to Yes/No questions (18-24 mos)
- produces a Yes/No question (24-30 mos)
- uses 40 words; 2/3 are nouns; < 20% are verbs (18-20 mos)
- uses modifiers (hot, big) and function words (no, more) (18-20 mos)
- knows *big/little* (30-36 mos)
- begins to use *in/on* (24-30 mos)
- knows *in front of/behind* (36-42 mos)
- identifies *hard/soft, rough/smooth* (36-42 mos)
- uses pronouns *this* and *that* (e.g., "That a dog." "It a doll.") (24-30 mos)
- uses pronouns (*I, you, me, mine*) (30-36 mos)
- knows *in, on,* and *under* (30-36 mos)
- uses *he, she, you, me, I, mine* (40-48 mos)
- uses a 2 - 3 word declarative utterance (30 mos)
- shakes head for "No!" (8-12 mos)
- uses negative sentences by attaching *no* or *not* to the initial position of a simple declarative sentence "No juice" while holding up an empty cup, or "Not meat" while pushing the spoon away (24-30 mos.)
- uses negative sentences to express *nonexistence* or disappearance (e.g., while looking for lost dog, says, "No, Spot" or noticing that something is not in sight says, "No bear") (24 mos)
- uses negative sentences to express rejection (e.g., when offered soup, says, "No soup.") (24 mos)
- uses negative sentences to express denial (e.g., when asked

"Is this your dog?" says "No Spot.") (24 mos)

- uses negative sentences by attaching the negative word next to the main verb in the sentence (e.g., "I no sleep" or "Mommy no go car.") (30-36 mos)

- uses 2-3 words to indicate wanting more of something (e.g., "More juice." "More swing.")

- uses 2 3 words to declare *possession* (e.g., "Mommy shoe." "My coat.") (18-24 mos)

- asks questions of the form "She go bye-bye?" for "Can she go bye-bye?" Most questions are like statements with a rising intonation at the end (30-36 mos)

- asks 2-3 word *questions* such as a) *Where?* b) *What?* and c) *Why?* types: "Why you go?" "Where my coat?" (26-32 mos)

- answers *Where?* questions (24-30 mos)

- answers *What doing?* questions (24-30 mos)

- answers "What do you hear?" (24-30 mos)

- answers simple questions*: Who?, Why?, Where?* and *How many?* (30-36 mos)

- combines 3-4 words in subject + verb + object format (24-30 mos)

- uses 4-5 word sentences (36-40mos)

- asks 2-3 word *questions* of the types: *Whose?, Who?* and *How?*

- begins asking *What?* and *Who?* questions (36-42 mos)

- asks *How?, Why?* and *When?* questions (42-48 mos)

- labels an *adjectival characteristic* of an object (e.g., "Big frog." "Pretty baby.")

- uses 2-3 words in an *agent-action* form (e.g., "Mommy go." "Doggie run.")

- uses a 2-3 word in an *instrument-action* form (e.g., "Hammer nail") to indicate the instrument that is performing an action

- uses 2-3 words in an *action-object* form (e.g. "Hit ball" "Drink juice.")

- uses 2-3 words in an *agent-object* form (e.g., "Daddy ball" "Mommy baby") to indicate someone or something in direct interaction/conjunction with another person or thing (e.g., mommy and baby are together)

- uses 2-3 words in *action-location*, "Sit cushion" to indicate the location of an action

- talks about objects and events that are not immediately present (24-36 mos)

- initiates spontaneous vocal interactions (24-36 mos)

- answers simple "*How?*" questions (36-42 mos)

- adjusts level of language to accommodate comprehension of younger children (36-42 mos)

- attempts conversational repairs when the converser has not understood (24-30 mos)

- most conversational repairs consist of using a different word even if it is not a more appropriate word (30-36 mos)

- in conversations, learns that short pauses mean that exchanges will continue and that long pauses mean that additional responses will not be made (36-40 mos)

- makes conversational repairs when converser has not understood (36-42 mos)

- correctly uses terms such as *this, that, here,* and *there* (48-60 mos)

CONVERSATIONS

Orelove and Sobsey (1996) report that "pragmatic conversational functions have been taught to students with severe disabilities in structured learning contexts and have generalized well to natural communication contexts" (p. 283).

Figure 17. Conversation

Teachers must be sensitive to learner's attempts to

communicate. They must be able to identify and interpret communicative attempts and respond in a manner that indicates to the child that they are interested and willing to become conversation partners. Receptiveness for communication can be conveyed by smiling, speaking in a soft warm tone and gently touching the student. Learners who have limited verbal communication may be particularly sensitive to the non-verbal messages sent by conversers (Kaiser, 2000).

Initiates Conversation

- the learner extends a greeting; waves; makes eye-contact; says "Hello;" calls someone's name
- interprets eye-contact, proximity and leaning toward as opportunities to converse
- initiates conversation with adults, peers, acquaintances and strangers
- gives something to someone; hands a toy to an adult; puts an object on a person's lap; points to something
- points to pictures in a *picture communication book* (e.g., points to a picture of a football player below which is printed "I like football")
- after a period of inactivity, makes a noise, cries, bangs something, hits self
- asks a question to which a response is expected: "Swim?" or "Are you going swimming?" or opens palms in front of body to ask a gestural question, requiring a "Yes or No" response or ask a question requiring an expanded response. "What do your think about ___?"
- provides information or makes a statement to which some acknowledgement is expected: "We are going to a movie tonight."
- comments about events, actions, objects, people
- can use information from shared events, radio, television or newspaper to initiate and maintain conversation
- uses an augmentative/alternative communication device to initiate communication (e.g, uses a Voice Output Communication Aid; draws a converser's attention to a picture

on a communication board)

Responds to Initiations

- the learner makes minimal verbal response: says "Uh Huh," "Yes" or "No."
- makes minimal gestural response: nods or shakes head, shrugs shoulders, moves toward, gives eye-contact, smiles
- makes extended verbal response: adds additional information and/or asks a question
- joins a group conversation by speaking on the same topic

Conversational Turn-taking

- the learner makes a 2nd pass through the sequences described above.
- takes 3 or more turns during conversation (asking, answering, commenting)
- does not interrupt or overlap with the other converser's speech
- predict on prosodic or syntactic grounds that the converser has finished his/her turn
- discriminates momentary gaps in the converser's speech in which she or he is looking for the right word or organizing a response from a gap indicating completion of a turn
- recognize that a nod (affirmation) or an "Uh Huh" may be a turn
- balances length of turn with time taken by converser so as not to dominate the conversation
- discriminates between obligatory turn-taking in which following a question an answer is required, and non-obligatory turns in which a response is not required, but if a response is made it can keep the conversation going (e.g., when someone says "I'm going to a show tonight," the learner can say either nothing or "Which one?")

Maintains Conversation

- the learner's successive responses during conversation are

topically consistent and sequentially related (e.g., stays on topic; one comment logically and topically follows the previous)

- focusses on the main theme of a topic rather than getting hung-up on some tangential element

- visually attends to converser (adult/peer) during discussion

- visually attends to a referent object/event or person named by an adult or peer converser during a discussion

- visually attends to a referent object/event or person to which the converser is attending during discussion

- attends to the speaker when requested to do so (e.g., during a demonstration)

- says or does something when the converser pauses or stops talking so as to take a turn or provide acknowledgement

- as appropriate, moves from topic to topic as new topics are introduced

- orients toward speaker (turns body and/or leans toward; looks at face/eyes)

- says, Yes," "Uh Huh" or "No,"; nods or shakes head; smiles or frowns, as appropriate, to show she or he is listening

- answers questions

- asks for clarification as required: "What?" "Why?" "What do you mean?" "What did you say?" "Huh?" "Eh?" "The big one?"

- when his or her turn occurs, responds with sufficient rapidity to maintain flow of conversation

Conversational Repairs

- the learner understands various ways a converser may indicate the message has not been understood (e.g., "What did you say?" "What's that?" "I didn't see what you pointed to." Converser shrugs his or her shoulders and/or raises hands palms up in front of chest)

When a converser fails to respond, reacts in a different way than expected or indicates a lack of understanding:

- the learner repeats the same information

- rephrases the information

- adds more or new information

- responds in a different style (e.g., changes from verbal to gestural communication)

- substitutes one or more words

- gives an example

- offers an explanation

- advises the converser that he or she has misunderstood the learner's message.

Terminates Conversation

- the learner discriminates when it is time to terminate a conversation (e.g., loss of eye-contact; converser moves away or looks at watch or says, "I've got to go." or "See you later" ...)

- closes conversation when other person is no longer talking

- indicates desire to close conversation by looking or moving away, or looking at clock, or by closing eyes

- says "O.K." "See you later." "Take care." "Good bye." or waves good bye.

JOINT-ATTENTION

Joint-attention refers to occasions when two people are simultaneously attending to each other, the same material or the same activity. Joint-attention increases the level of engagement between partners and the likelihood of shared communication (Kaiser, 2000).

- the learner shows a toy to get someone to look at it

- points to a picture to get someone to look at it

- holds up a box and shakes it with a questioning expression to ask "What's inside?"

- points at something and vocalizes with rising intonation to ask "What is it?"

- establishes joint-attention of himself and another person to an interesting object or activity by pointing to the object or activity

- establishes joint-attention by pulling someone over to an activity

- establishes joint-attention by presenting or giving the object to someone

- looks at an object presented in the line of vision when a converser shakes the object, when the object makes a noise, or when the object is brightly colored, intense and/or changing

- looks at an object presented in the line of vision

- looks at an object presented in peripheral view when the person shakes the object, when the object makes a noise, or when the object is brightly colored, intense and/or changing

- reaches for, or points to an object while attending to a someone

- follows a converser's line of regard to look at people, objects or events to which the converser is attending

- looks at any object presented in peripheral view by a converser

- looks at an item when a converser says "Look" and then looks at a person, object or activity

- looks at an object, person or activity to which a converser points

- plays joint action games, such as peek-a-boo, "I'm going to get you," "Eensy weensy spider man" and "Pat-a-cake," in which both the converser and the learner attend to an action; the learner responds to the partner's actions and may take turns imitating the partne'rs actions

Uses Non-Symbolic Communication to Direct Joint-Attention to an Object or Event

- the learner shows a toy to get someone to look at it

- points to a picture to get someone to look at it

- holds up a box and shakes it with a questioning expression to ask "What's inside?"

- points at something and vocalizes with rising intonation to ask "What is it?"

OTHER COMMUNICATIVE CONSIDERATIONS

Aesthetics

- *responsive listening*: perhaps one of the most important aspects of communication is reinforcing the *speaker* by being a responsive listener; evidenced by: a) giving eye-contact, b) smiling, c) nodding, d) paraphrasing ...
- the learner uses normatively appropriate or conventional rather than idiosyncratic gestures, sounds and body language
- *etiquette*: uses "Please." "Thank you." "Excuse me." "Pardon me." and "I'm sorry."
- verbal sounds/noises are normatively acceptable
- establishes and maintains appropriate proximity for conversations, neither too close nor too far away
- uses variations in conversational topics and style rather than following a stereotypical approach (e.g., does not simply ask questions: "What is your name?" "What time is it?")
- *intelligibility:* communication, whether verbal, gestural, sign and/or other is understandable to: familiar staff and peers and to unfamiliar people,
- absence of excessive or inappropriate vocalizations: squeals, screams, cries
- voice is neither too loud nor too quiet
- adjusts volume to loudness of surrounding sound
- speaks softly when private information is being conveyed
- speaks louder to groups than to individuals
- waits for others to finish speaking before beginning to speak and before leaving the conversation
- does not speak with food in his or her mouth
- does not use vulgar, coarse or profane language
- does not introduce topics that are vulgar or considered

private.

Telephone

(cell phone, desk phone, pay phone)

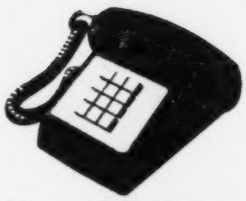

Figure 18. Telephone

- the learner uses a list of emergency and frequently called numbers posted next to the telephone
- calls 911 or 0 to obtain fire, medical or police assistance
- when 911 is called, provides essential information: type of emergency, address
- uses telephone to call home to request assistance (e.g., ride); identifies location; reports on activity
- uses a telephone to contact school, work-site, case worker, health centre, etc.
- dials number him/her self or ask for operator assistance or a bystander's assistance to connect to a number
- hangs up if no answer after 6 rings, wrong number, telephone busy or error message received
- if appropriate, leaves a message on a telephone answering device following a tone
- if appropriate, answers a ringing telephone at residence
- distinguishes which phones should/ should not be answered when one of several telephones rings
- calls requested person to phone; if person not available, either takes message or asks the caller to phone later
- if appropriate, will not indicate to unfamiliar caller that he or she is at home alone
- uses telephone to make social calls to friend or family member
- calls number for recorded information: weather, movies

- calls numbers and asks questions and/or pushes buttons, as directed, to obtain desired information
- asks for direction to locate a public telephone
- uses a public telephone by depositing coins, using a calling card number, swiping a calling card or using a prepaid card
- when using a public telephone, follows the proper sequence of steps: picks up telephone, inserts the correct coins or uses the cards, and dials the number; or if the operator is used to call a number, deposits coins after the operator makes a request.

APPENDIX A

SUPPLIERS, MANUFACTURERS AND ORGANIZATIONS RELATED TO AUGMENTATIVE AND ALTERNATIVE METHODS OF COMMUNICATION

Sources of Information

Quist and Lloyd (1997) provide a comprehensive and detailed introduction to high technology augmentative and alternative communication equipment. *Closing the Gap* lists over 2000 products related to computer technology in special education and rehabilitation - an excellent source of information. Electronic communication devices are also reviewed at the following sites.

http://polio.dyndns.org/chip/seleccom.htm

http://www.closingthegap.com

More extensive lists of manufacturers, suppliers and AAC organizations are available from Lloyd, Fuller and Arvidson (1997). See also Software and Hardware vendors listed below.

http://www.rit.edu/~easi/ak12/k12/k12hvendors.html

AbleNet, Inc., 1081 Tenth Avenue. S/E. Minneapolis, MN 55414-1312; Tel. 612-379-0956; Fax 612-379-9143; *mounting systems, switches, toys, aided symbols, input adaptations, resource materials and environmental controls.*

http://www.ablenetinc.com/home.html

AdaptAbility, P.O.B. 515, Colchester, CT 06415-0515. Tel 203-537-3451. *communication aids and adaptive equipment.*

Adaptive Communication Systems (ACS) Technologies, Inc., 1400 Lee Dr., Suite 3, Corapolis, PA 15108; Tel. 412-269-6656; Fax 412-269-6675; Voice Output Communication Aids , *speech synthesizers and environmental controls*.

Alton Technical Service, 9492 Township Hall Road, Rapid River, MI 49878 USA.Vox: 906-474-9477; Fax 906-474-9689.

American Foundation for the Blind, Technology Center, I I Penn Plaza, Ste. 300, New York, NY 10001; Tel. 212-5027642; Fax 212-502-7773; techctr@afb.org.

http://www.afb.org/

American Printing House for the Blind, 1839 Frankfort Ave., P.O.B. 6085, Louisville, KY 40206-0085; Tel. 502-895-2405.

http://www.aph.org/aph1.htm

Arroyo & Associates, Inc., 2549 Rockville Centre Parkway, Oceanside, NY 11572; Tel. 516-763-1407; Fax 516-766-4119; *aided symbols and, input adaptations.* ronarr@aol.com Note: Arroyo no longer manufactures products and refers contacts to *Closing the Gap* for information on communication systems on the market today.

http://www.closingthegap.com

Assistive Technology, Inc., 850 Boylston Street, Chestnut Hill, MA 02167-2402; Tel: 800-793-9227; 617-731-4900; Fax 617-731-5201.

http://www.assistivetech.com/

Attainment Company, Inc., P.O.B. 930160, Verona, WI 53593-0160; Tel. 608-854-7880; *Picture Cue Dictionary and Picture Prompt System.*

http://www.attainment-inc.com

Audiological Engineering Corp. 35 Medford Street, Somerville, MA 02143 *Tactaid 2000 and Tactilator.*

http://www.tactaid.com/

Blissymbolics Communication International (BCI) (previously known as Blissymbolics Communication Institute), 1630 Lawrence Ave. West, Suite 104, Toronto, Ontario M2J 459, Canada. Tel. 416-242-2222. ortckse@oise.on.ca.

http://home.istar.ca/~bci/

Canon USA, Inc., *Voice Output Communication Aids and adaptive equipment.* One Canon Plaza, Lake Success, NY 11042; Tel. 516-488-6700.

ComputAbility Corp., 40000 Grand River, Suite 109, Novi, MI 48375; Tel 313-477-6720; Fax 313-477-6324; *aided symbols, input adaptations hardware, software, speech synthesizers, environmental controls, mounting systems and switches.*

http://www.cc-inc.com/computability.htm

Creative Switch Industries, P.O.B. 5256, Des Moines, IA 50306, Tel. 800-257-4385, 515-287-5748; *environmental control, mounting systems and switches.*

Crestwood Company, 6625 N Sidney Place, Milwaukee, WI 53209-3259; Tel. 414-352-5678; Fax 414-352-5679; crestcomm@aol.com; *communication aids, input adaptations, switches, Talking Pictures, Voice Output Communication Aids and toys.*

http://www.communicationaids.com/

Designing Aids for Disabled Adults, 249 Concord Ave, #2, Toronto, Ontario M6H 2P4, Canada: Tel. 416-530-0038; *keyboard interface and alternate keyboards.*

Don Johnston Incorporated, P.O.B. 639, 1000 N. Rand Rd. Bldg 115, Wauconda, IL 60084-0639; Tel. 800-999-4660 (US and Canada), 708-526-2682; Fax 708-526-4177; *aided symbols, assessment tools, adaptive input, mounting systems, switches, environmental controls, hardware, software, resource materials and speech synthesizers.*

http://www.donjohnston.com

Ednick Communications, Inc., P.O.B. 3612, Portland, OR 97208; *aided symbols and manual communication products.*

EKEG Electronics Co. Ltd., P.O.B. 46199, Station G, Vancouver, B.C., Canada V6R 4G5; Tel. 604-273-4358; Fax 604-273-1148; richmush@Direct.ca; *alternate keyboards, input adaptations and hardware.*

http://www.edegelectronics.com/

ENABLE, Schneier Communication Unit, 1603 Court St, Syracuse, NY 13208; Tel. 315-455-7591; software, environmental control, scanning and direct selection.

http://www.enable1.org/index.html

Equal Access to Software and Information (EASI), c/o AAHE, One DuPont Circle, Suite 360, Washington, DC 20036; Tel. 202-293-6440 x48; *adaptive technology and disabilities resources.*

http://www.rit.edu/~easi/

H.K. Eyecan, Ltd. 36 Burland Street, Ottawa, ON K2B 6J8; info@eyecan.ca.

http://www.olsc.ca/corporate/hkeyecan.htm

Franklin Learning Resources, 122 Burrs Rd., Mr. Holly, NJ 08060@ Tel. 800-525-9673, 609-261-4800; Fax 609-2618368; *Language Master.*

Gallaudet University Press, Kendall Green, P.O.B. 300, Washington, DC 20002; *manual communication products.*

http://gupress.gallaudet.edu/

Handicapped Children's Technical Services, Box 7, Foster, RI 02825; *switches, toys, hardware, software and environmental controls.*

Helen Keller National Centre, 112 Middle Neck Rd. Sands Point, NY, 11050-1299. Tel. 800-2550411, ext 311. *deafblind materials.*

http://www.helenkeller.org/

IBM National Support Center for Persons with Disabilities, P.O.B. 2150, Atlanta, GA 30301-2105; Tel. 800-426-2133(V), 800-284-9482(TDD). Offers hardware and software designed for those having disabilities. Publishes *Guide to Resources for Persons with*

Disabilities.

http://www-3.ibm.com/able/

International Society for Augmentative and Alternative Communication (ISAAC). P.O.B. 1762-Station R. Toronto, Ontario M4G 4A3, Canada: Tel. 905-737-9308; Fax 905-737-0624; liz_baer@mail.cepp.org.

http://www.independentliving.com/

Independent Living Aids, Inc., 27 East Mall, Plainview, NY 11803@ Tel. 800-537-2118; Fax 516-752-3135; *vision technology.*

Innocomp, 26210 Emery Rd., Suite 302, Warrensville Heights, OH. 44128, Tel. 800-382-8622, 216-464-3636; Fax 216-464-3638; innocomp@aol.com; *software, aided symbols, mounting systems, switches and environmental controls.*

http://www.sayitall.com

Intellitools, Inc.. 1720 Corporate Circle, Petaluma.CA, 94954. *Intellikeys and Intellitools software.*

Intex Micro Systems Corp. 755 West Big Beaver Road, Suite 1717 Troy, Michigan (313)-362-4280.

Kurzweil Educational Systems. *OMNI 1000: OCR reading systems for the blind.*

http://www.kurzweiledu.com

The Lighthouse, Inc. 111 E. 59th Street. New York, NY 10022 Tel1-800-334-5497, (212) 821-9200; vision.

http://www.lighthouse.org

Makaton Vocabulary Development Project, Camberley, Surrey GU15 3QD, England; *Makaton materials.*

http://www.makaton.org/

Mayer-Johnson Co., P.O.B. 1579, Solana Beach, CA 92075-1579; Tel. 619-550-0084; Fax 619-550-0449: *software, Picture Communication Symbols (PCS)* and *resource materials.*

http://mayer-johnson.com

Phonic Ear, Inc., 3880 Cypress Dr., Petaluma, CA 94954-7600@ Tel. 800-227-0735, 707-769-1110; Fax 707-769-9624; *communication aids, aided symbols, resource materials, software, mounting systems.*

http://www.phonicear.com/

Pictogram Centre. Saskatchewan Association of Rehabilitation Centres, Saskatoon, Saskatchewan, Canada; *Pictogram Ideogram Communication (PIC).*

Prentke Romich Co. 1022 Heyl Rd., Wooster, OH 44691; Tel. 800-262-1984, 216-262-1984; Fax 216-2634829; *Voice Output Communication Aids, input adaptations, environmental control, aided symbols, hardware, software, speech synthesizes, communication aids, mounting systems and switches.*

http://www.prentrom.com

Pro-Ed, 8700 Shoal Creek Blvd., Austin, TX 78757-6897; Tel. 512-451-3246; *aided symbols. manual communication products, assessment tools and tests.*

http://www.proedinc.com

Rehabilitation Engineering Research Centre on Adaptive Computers and Information Services. Trace Center, University of Wisconsin, Waisman Center, S-151, 1500 Highland Avenue, Madison, WI 53705; Tel. 608-262-6966 (v); 608-263-5408 (TDD); Fax 608-262-8848.

Rehabilitation Engineering Research Centre on Assistive Technology and Environmental Intervention for Older Persons with Disabilities and **Rehabilitation Engineering Research Centre on Technology Evaluation and Transfer**, State Univer-

sity of New York, Buffalo, Center for Assistive Technology, 515 Kimball Tower, Buffalo, NY 14214; Tel. 800-628-2281 (V/TDD); Fax 716-829-3217.

Rehabilitation Engineering Research Centre in Augmentative and Alternative Communication, and **Rehabilitation Engineering Research Centre on Rehabilitation Robotics to Enhance the Functioning of Individuals with Disabilities.** University of Delaware, A.I. duPont Institute, 1600 Rockland Rd., P.O.B. 269. Wilmington, DE 19899; Tel. 302-651-6830; 302-651-6834 (TDD); Fax 302-651-6895.

Rehabilitation Engineering Research Centre on Hearing Enhancement and Assistive Devices. The Lexington Center, Inc., Research Division, 30th Avenue and 75th Street, Jackson Heights, NY; Tel. 718-899-8800 x230; (V/TDD); Fax 718-899-3433.

Rehabilitation Engineering Research Centre on Modifications to Worksites and Educational Settings. Cerebral Palsy Research Foundation of Kansas, 2021 North Old Manor, Box 8217, Wichita, KS 67208-0217; Tel. 316-688-1888 (V/TDD); Fax 316-688-5687.

Rehabilitation Engineering Research Centre on Rehabilitation Technology Services in Vocational Rehabilitation, South Carolina Vocational Rehabilitation, Department 1410-C, Boxton, Avenue West, Columbia, SC 29170, Tel. 803-822-5362 (V/TDD); Fax 803-822-4301.

Rehabilitation Engineering Research Centre at Smith-Kettlewell Eye Research Institute, 2232 Webster St., San Francisco, CA 94115; Tel. 415-5611630; Fax 415-561-1610.

Rehabilitation Engineering and Assistive Technology Society of North America (previously the Rehabilitation Engineering Society of North America), 1700 N Moore St., Suite 1540, Arlington, VA 22209-1930: Tel. 703-524-6686 (V); 703-524-6639 (TDD); Fax 703-524-6630; natoffice@resnq.org.

http://www.resna.org/

Sentient Systems Technology, Inc. 2100 Wharton St., Suite 630, Pittsburgh, PA 15203; Tel. 800-344-1778, 412-3814883; Fax 412-381-5241; sstsales@sentientsyscom; Voice Output Communication Aids, input adaptations and mounting systems.

Sighted Electronics, Inc., 464 Tappan Road, Northvale, NJ 07647; Tel. 800-666-4883; Braille products and vision technology.

http://wwwsighted.com/

Syntha-Voice Computers, Inc., 125 Gailmont Dr., Hamilton, ON L8K 4B8, Canada; Tel. 800-263-4540; Fax 905-662-0568; help@synthavoice.on.ca.

http://www.synthavoice.com/

TASH International, Inc., Unit 1, 91 Station St., Ajax, Ontario, LIS 3H2 Canada; Tel. 800-463-5685, 905-6864129; Fax 905-686-6895; tashcan@aol.com; *input adaptations, aided symbols, speech synthesizers, mounting systems, switches, hardware, software and environmental control.*

http://www.tashinc.com/

TBS Marketing, 17059 El Cajon Ave., Yorba Linda, CA 92686; Tel. 714-524-4488; environmental control.

The Association for Persons with Severe Disabilities (TASH), 11201 Greenwood Avenue N, Seattle, WA 98113.

http://www.tash.org/

Therapy Skill Builders, 3830 E Bellevue, Dept. C, Tucson, AZ 85716; aided symbols, resource materials and manual communication products.

http://www.hbtpc.com/catalogs/tsb/tsb_info_page.htm

Toys for Special Children-Enabling Devices Inc., 385 Warburton Ave., Hastings-on-Hudson, NY 10706; Tel. 800-832-8697, 914-478-0960; Fax 914-478-7030; aided symbols, input adaptations, hardware, environmental control, mounting system, switches and toys.

http://www.enablingdevices.com/http

Trace Research and Development Center, University of Wisconsin-Madison, S-151 Waisman Center, 1500 Highland Ave., Madison, WI 53705-2280; Tel. 608-262-6966, 608-263-5408 (TDD); info@trace.wisc.edu; input adaptations, resource materials, hardware and

Hyper-ABLEDATA.

http://trace.wisc.edu

Unicorn Engineering Inc., 5221 Central Ave, Suite 205, Richmond, CA 94704, 800-899-6687 or 415-528-0670.

United Cerebral Palsy Association, 1660 L St. NW, Suite 700. Washington, DC 20036; Tel. 800-872-5827 (V/TDD); Fax 202-776-0406.

http://www.ucpa.org/index.cfm?error=1

Words+, Inc., 40015 Sierra Hwy., Bldg. B-145, Palmdale. CA 93550; Tel. 800-869-8521, 805-266-8500, 805-266-8896 (BBS); Fax 805-266-8969; phil@words-plus.com: input adaptations, aided symbols, software, hardware, Voice Output Communication Aids, speech synthesizers, mounting systems, switches and environmental controls.

http://www.words-plus.com

Xerox Imaging Systems, Inc., 9 Centennial Drive, MA 01960 Peabody, USA. 508-977-2000 *(US)*: +1 800 248 65 50; Fax 508-977-2435.

http://www.xerox.com/go/xrx/templage/013.jsp

Zygo Industries, Inc., P.O.B. 1008, Portland. OR, 97207-1008: Tel. 800-234-6006, 503-684-6006; Fax 503-684-6011; input adaptations, aided symbols, hardware, communication aids, Voice Output Communication Aids, mounting system and switches.

http://www.zygo-usa.com/

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INDEX

AAC 65
AAC Multi-Component Communication System Requirements 42
AAC System Picker 32
abbreviation expansion 56
abstract symbols 25, 31
acceptance gestures 79
access 57
AccessBliss 28
Accessibility Guides 61
Accessibility Wizard: 61
ACE Centre-North 32
acknowledgement gestures 79
action-location 120
action-object form 120
activate and stop the switch 103
adaptations to computers 57
adapted toys 44
adjectival label 94
adjectives 77
adjust speech for conversation partners 48
Adobe Acrobat Reader iv
Adobe PDF iv
advantages of gestural language 17
adventitiously deaf 38
aesthetics 126
Affirmation 75
agent-action form 120
agent-object form 120
aided and unaided techniques to communicate 14
aided communication 14
aided methods of Augmentative/ Alternative Communication (AAC) 24
aiding communication in education 32
air cushion or squeeze switches 44
air pressure switches 44
albums 34
AlphaTalker 37
alternative communication 14
alternative keyboards 60
alternative mouse controls 56
Amer-Ind 15
American Sign Language 16, 55, 69
AMESLAN 16

amplification 50
animated switch controllers 44
answers simple questions 119
aphasic 16
APPENDIX A 129
Apple Resources for People with Disabilities 62
arbitrary symbols 27
array of objects, words, or symbols 99
array of words, objects, symbols 111
articulation problems 30
articulatory dyspraxia 30
asks a question 119,121
ASL 16, 55, 67
attending 64
attention 65
attention seeking gestures 79
attention-getting behavior 67
attracting attention 65
auditory scanning and converser assisted selection 100
augmentative and alternative methods of communication 14,32, 78,129
augmentative communication 17
autism 11, 14, 16, 17, 21, 25, 28, 29
automatic scanning 103
A-Z to Deafblindness 16
big/little 118
BIGmack 34
bilateral signs 20
black and White Line-drawings 25
black and white or color photographs 25, 85
blind 55, 56
Bliss Processor 28
Blissymbols 27, 31, 41, 90, 92
Blissymbolics Communication International 28
Boardmaker 26, 49
body language 54
Braille 39, 55, 56
Braille printers 56
British Sign Language 16, 29
"Brush the doll's teeth" 72
bulb, air cushion or squeeze switches 44
button switches 43
calendar boxes 33
Canon Communicator 36

cassette recorders 34
categorically organized 110
categories of pictures 33
category/page-item electronic scanning 110
cerebral palsied 16, 28
checklist, ... 41
choice of an AAC system 32
choice-making mands 46
Choices 70
choosing enabling switches 44
circular display of words, pictures, objects 106
circular electronic scanning 106
Clarke School Auditory Enhancement Guide 52
classifications 110
"Clean the lunchroom table," 72
ClickIt 60
clock communicators: scanning communication aids 35
clock-like display 106
closed circuit television 55
Closing the Gap 31, 35
cochlear implants 38
color photographs 25
Comboard 35
"Come here." 72
comments 122
communicating with miniatures 90
communication and hearing impairments 50
communication and visual impairments 53
communication board 65, 84, 87, 88, 91, 92
communication board on a computer screen 37
communication boards 34, 40, 97
communication book 33, 39
communication cards 33
communication charts 33
communication devices 31
communication display 31, 102, 103, 105
communication domain learning indicators 63
communication partner 30, 33, 28, 34, 42, 48
communication technology/computers 55
communication using parts of objects 93
communication vests 33
communication wallets 34
communicative attempts 121

communicative demands 18, 21
communicative functions 42
comprehends a converser's non-symbolic communication 75
computer access products for blind and visually impaired users 56
computer monitor 87
computer technology 31
content of the communication 11
continuous cursor movement 103
control panel 59, 62
conversation book 49
conversation displays 34
conversational repairs 120, 123
conversational topics 126
conversational turn-taking 49, 122
conversations 120
conversations skills 48
converser assisted selection 100, 101
conversers 64
Copy-N-Paste v
core vocabulary 29
correction procedures 97
corrective feedback 46
counterclockwise 106
crossed fingers 82
current and future environments 30
cursor 103, 105
cursor is stopped too early or too late 104
daily activity 45
deaf 29
deaf community 16
deafblind 25, 53-55, 112
deafblind manual communication 16
deafness 29, 38
describes 73
describes common community location 74
describes events, actions, properties, conditions, processes, or 73
describes locations, directions and times 74
describes personal state: beliefs, attitudes, emotions, discomfo 74
developing the use of pictures/photographs for communication 85
developing use of objects for communication 82
dial scan 36
dictionary of sigsymbols 27
difficult signs 20

digital signal processing 38
digitized tape 37
direct selection 99
directed electronic scanning 111
disadvantages of sign communication 17
Discover: Board 60
Discover: Screen 60
discrete trial 28
distractor objects 83
Don Johnston Developmental Equipment 26
"Do you want ___ (e.g., milk or juice)?" 71
"Do you want ___?" 70
"Do you want a ___ or a ___ (names of items)?" 70
"Don't know." 71
drink 113
Duxbury Braille Translation 38
E-TRAN (Eye TRANsfer) Frames 34
E-TRAN Eye-Pointing 98
early language development 116
eat 113
ecological inventory 21
ecological inventory of communication 18
eight stages corresponding to normal language development 29
elaborated response 46
electronic cameras 32
electronic communication devices 35
electronic keyboard 28
electronic keyboard operated communication devices 36
electronic scanning 102
electronic scanning communication devices 36
electronic technology 40
emergency 127
Enabling Devices, a Division of Toys for Special Children 43
enabling Switches 43
English Deafblind Manual Alphabet 16,55
enhance the development or improvement of speech 29
environmental 110
environmental control devices 43
environments 18
establishing production 24
etiquette 126
expressive communication 13
expressive gestures 79

external screen magnifier 57
eye movement 37
Eye TRANsfer 34
eye-contact 64, 121
facial expression 12
fading 28
FilterKeys: 61
"Find___." 100
fingerspelling 15, 55
fire 127
fluency 41
folding communication boards 34
font size 57
form of protest 68
forms of communication 11
4-7 word sentences 118
Fristoe and Lloyd's list of initial, expressive signs 22
full supination 82
function of protest 68
functional 18
functional analyses of behavior 13
functional analyses of the communicative intent of behavior 13
functional assessment and program development for problem behavi 13
functional communication 11
functional communicative importance 21
functions or purposes served by communication 11
fur 93
gaze 98, 99
generalize learning 14
gestural Communication ..... .15,78
gestures and signs 17
gestures/signs and speech production 23
gesturing 12, 78
"Go to the ___ (familiar location in home, school or work site) 72
grammatical speech 31
graphic systems 40
greeting 121
Grid Maker 26
"Give me ___" 71
guidelines for selecting an augmentative and alternative system 30
hands book to an adult to request 117
he, she, you, me, I, mine 118
head pointer 97

head stick 97
head switches 43
head-point 101
head-pointer 33,57
Headmaster 58
HeadMouse 58
hearing aid 52
hearing aids 38, 50, 51
hearing impairments 50
hearing loss 50
high contrast 61
high tech communication devices 35
Home Message Digital Recorder 35
homonyms 26
hot spots 59
"How?" questions 120
"How far is it to ___ (unknown location)? 71
"How old are you?" 70
How?, Why? and When? questions 119
I, you, me, mine 118
iconic symbols 31
iconic systems 40
iconicity of signs and gestures 17,21,31
icons 40
ideographic 26
ideographs 26, 27
idiosyncratic 15, 40
idiosyncratic form of communication 11
Imaginart 25
imitation 45, 118
important factors influencing the choice of an AAC system 32
in front of/behind 118
in, on, and under 118
incidental teaching 28, 47
incorrect selection 101, 112
Indicating "Want" gestures 80
Individual Program Plans (IPPs) v
Infogrip 58
Information Resources for Blind and Visually Impaired 55
infrared beam 58
infrared light reflected from the eyes 37
infrared-sound-touch switches 44
inhibit speech 24, 28

initial, expressive sign lexicon 22, 23
initial words/signs 21
initiate communication. 28,48,121
instrument-action form 120
intelligible 117, 126
Intellipoint 62
IntelliKeys 60
IntelliTools 60
interference 45, 47
international languages 26
interrupt 122
interruption of speech 49
IntroTalker 37
inverse scanning 105
joint-attention 46, 124-126
joystick 43, 58, 111
Jumpstart Toddlers 59
key rings 33
keyboard 59
keyboard enhancement utilities 62
keyboard modification programs 56
keyboard overlay 59
keyboard redefinition programs 56
keyguard 59
keystrokes 56, 59, 61
Kurzweil Personal Reader 37
label 73,74,85,94
laminated symbols or picture cards 33
language delays 16
Language development 116
large or small displays of symbols and pictures 37
large print 55
LCD display 37
leaf switches 43
learning indicators . . . . . v, 63
lexical development 24
lie down 113
light-activated switches 44
light-pointers 37, 57
line-drawing symbols 29
line-drawings 25, 26, 31, 40, 87
linear electronic scanning 107
"Line-up." 73

Ling, 1989 51
lip reading 38
Little Tactile Device 38
logos 29
"Look at ___(fixated eye-gaze)." 100
low tech communication devices 32
LTD(Little Tactile Device) 38
macros 59
magazine pictures 34
maintaining conversations 49, 123
maintenance of learning 14
Makaton Vocabulary 29
Makaton Vocabulary Development Project 30
making requests 66
mand-model procedure 46
manual signs 17
Manually Coded English 55
manufacturers 129
manufacturers and organizations 31
Margaret Walker 30
match pictures to the actual items 25
match-to-sample 74
Mayer-Johnson, Inc 26
MCE 55
medical 127
medium Tech Communication Devices 34
mercury Switches 43
MessageMate 37
Microsoft Magnifier 62
Microsoft Windows Resources for People with Disabilities 61
middle ear problems 52
mild hearing loss 50
mileau methods for teaching communication 45
miniature objects 32
miniature representations 24, 90
mixed mode approach 39
model 48
modelling procedure 45
moderate hearing loss 50
motoric abilities 19, 20
mouse 58
mouse functions 57
mouse keys 62

mouth-sticks 57
mouthpiece 44
multi-modal approach to communication 29
multiple forms of communication 39
multiple-message recording 35
names 118
names actions 74
names common objects 74
names common rooms 74
names objects or events 73
names objects spontaneously 117
Native American Indian hand-talk 15
natural gestures 15, 40
natural settings 14
naturalistic/milieu teaching 45
naturally occurring, daily activities 14
negations, protests, rejects 68
negative sentences 118, 119
911 127
"No!" 116, 118
nod 122
nods or shakes head 122
non-compliance and self-injury as methods of communication 13
non-obligatory turns 122
non-symbolic communication 12, 63, 75, 126
normalized the form of communication 40
note-taking instruments 56
nouns 75
object communication 24
object cues 54
objects 82
obligatory turn-taking 122
on-screen keyboard 56, 62
one- and two-step instructions 71, 117
one-handed keyboard software 56
opaque gesture 21
opportunity to interfere 45
opposed grasp 81
optical pointer 58
optimal speech communication assistance for residual hearing 38
oral language 50
organizations 31, 129
orients 123

OSCAR (Optimal Speech Communication Assistance for Residual Hear 38
overlap 122
overlap or interruption of speech 49
Overlay Maker 60
overlays 60
p-switch 44
palmer grasp 81
pants off 113
pants on 113
Parrot 35
partial response 46
partially imitating 46
parts of objects for communication 93
parts of speech 75
pauses 120
PCS 25
Peabody Reading Scheme 26
Peabody, Rebus Program 29
PECS 24, 28
phonemes 52
photo albums 33
photo boards 33
photodetection devices 37
photographs 25, 31, 34, 40, 85
phrases 118
PIC 26
Picsyms 26
Picsyms Categorical Dictionary 26
pictograph communication 89
Pictographic Ideogram Communication (PIC) 26
pictographs 15, 26, 27, 87, 88
picture communication book 121
Picture Communication Symbols (PCS) 25
Picture Exchange Communication System 24, 28
pictures 32, 33, 85
plexiglass frame 34
pneumatic, bulb, air cushion or squeeze switches 44
"Point to ___." 100
"Point to the ___," 71
pointer 34, 35
pointer boards 34
pointing 39
pointing by hand 33

pointing radial finger 81
pointing ulnar finger 82
Polaroid pictures 32
police 127
portable communication aid 36
potential reinforcer 45
Practical Sign Language Dictionary 21
pragmatic communication 11
pragmatic conversational functions 120
pragmatic functions 63
pre-arranged response 33
Prentke Romich Communications 37
pre-signing motor skills 81
prearranged signal 100, 101, 104
prehension patterns 81
prepositions 78
prerecorded 34, 37
presents a caregiver with an object or toy 66
print on palm 55
Print to Braille 37
print to speech devices 37
printed words 95
product labels 29
product logos 94
profound hearing loss 50
prompting 28
pronouns 76
prosodic 122
provides information 121
proximity 65, 121, 126
pulls a caregiver to an object 66
pulls adult to location 117
Purdue University Technical Assistance Team 18
push switches 44
"Put your hand up." 73
RadioShack 35
Reader Rabbit Toddler 59
reading system 37
RealVoice 36
Rebus 26
Rebus Glossary 26
receptive and expressive symbol communication 30
receptive communication 13

receptive understanding of gestures 81
recording photo albums 35
records six messages 35
redundant cues 39
rejection gestures 79
release 82
repeat rates 60
rephrases 124
representational graphic symbols communication 25
request assistance 80, 127
request object 116
requests 66, 70
resource directory 31
resource vocabulary 29
responds to initiations 122
responsive listening: 126
Revised Makaton Vocabulary 29
Roller Plus Trackball 58
rotary, scanning device 36
row and column electronic scanning 108
scanner 37
scanning 34, 36, 99, 106, 107, 110
scanning and selection of displayed communication items (objects 99
scanning communication aids 35
ScanPAC 36
schedule of activities 33
schedule or calendar boxes 33
screen clarifiers 56
screen magnification software 56
screen readers 56
SEE 16
selecting symbol types 30
selection of a communication system 41
semantic 110
semantic category 26
sensorineural hearing levels 52
sentence strips 28
sequential formats 28
severe hearing loss 50
shaping 28
shift key 56
shill 48
shirt/coat/jacket off 113

shirt/coat/jacket on 113
shoes/socks off 113
"Show me ___." 100
Show Sounds 61
sign and symbol vocabulary selection 18
sign complexity 20
sign dictionary 21
sign iconicity 21
sign language 39, 54
sign selection according to motoric difficulty 19
Signed Exact English 16
signs 21, 81
signs and speech production 23
signs per spoken utterance produced by teachers 24
Sigsymbols 27
single muscle sensors (p-switch) 44
sip/puff switches 44
sit down 112
Six Sound Test 52
social acceptability 41
sound perception 52
Sound Sentry 61
specialized keyboard 58, 59
Spectronics 26
speech capability 36
speech input systems 56
speech output 36
speech production 23
speech recognition programs 59
speech sounds 50, 113
speech synthesizer. 37, 56
speech synthesizers and speech input systems 56
speechreading 39
Spinner 85
squeeze switches 44
stand up 112
Standard Rebus Glossary 26
stays on topic 123
step element scanning 102
StickyKeys 61
string switches 43
strokes 30
substitutes 124

suppliers 129
suppliers, manufacturers and organizations 31, 129
supplies requested information 70
sustains topic 118
switch 36, 105
switch activated voice recordings 34
switch operated pointer 34
switches 34, 35
switches for computer access 44
switches in communication 102
switches related to head support 44
symbols to sentences 26
syntactic 122
synthesized speech 36
systematic scanning 98
systematically scan 100
Tactaid 2000. 38
Tactaid II. 38
Tactilator 39
tactile communication with deafblind learners 112
tactile output devices 56
tactile sign language 54
tactile speechreading 16
tactile transducers 38
tactiling 51
Tadoma 16, 51
Talk Back 35
Talker 11. 36
talking book libraries 55
Talking Picture Frame 35
Talking Screen 37, 59
talking word processor 61
tangible symbols 32, 53, 54
tape output 36
tape-loop devices 34
target communication item 103
target item 99, 107
TASH Inc. 36
task demands 18
teach communication skills in natural settings 14
teaching communication 45
teaching conversations skills 48
telephone 127

terminates conversation 50, 124
text to speech 36, 37
textured materials for communication 25, 93
3-ring binders 33
three step command 117
three to four word combinations 118
thumb abduction 81
thumb adduction 81
time delay procedure 46
topics of conversation 48
total communication 29, 39
touch 85
touch cues 54
touch screen 60
"Touch the ___" 71
TouchWindow 57
"Touch___ with finger or head-pointer" 100
Trace Center 44, 55
track pad 58
trackball 58, 60
transparent gesture 21
turn-taking 24, 49, 122
turn-taking in play 117
turn-taking is non-obligatory 49
turn-taking is obligatory 49
turns head 117
two step command 117
2-3 word questions 119
two word combinations 117
unaided methods of augmentative/ alternative communication 14
unaided techniques to communicate 14
Unicorn 58
Unicorn expanded keyboard 58, 60
unilateral/bilateral patterns 82
UNIX v
uses non-symbolic communication to direct joint-attention to an 126
using Blissymbols 92
using Blissymbols for communication 90
using communication boards for communication 97
using E-Tran eye-pointing 98
using line-drawings/ pictographs for communication 87
using miniature representations for communication 90
using parts of objects for communication 93

using printed words for communication 95
using product logos or labels for communication 94
using signs 21
using switches in communication 102
using textured materials for communication 93
velcro 28, 93
velcro backed symbols 33
verbal turn-taking 118
verbs 77, 118
vibrotactile communication devices 38
vibrotactile hearing aids 38
vibrotactile perception of speech sound 51
VisionKey 37
visual impairments/disabilities 25, 37 53, 55, 56, 57
visual scanning and converser assisted selection 101
visual scanning and direct selection 99
voice input/output 36, 37
voice messages 34
vowels and consonants produced 117
wallet 34
want 66
"Want juice?" 70
What? and Who? questions 119
"What do you like to eat?" 70
"What do you want?" 101
"What is this?" 74
"What is your brother's/sister's/mother's/father's name?" 70
"What T.V. shows do you like?" 70
"What's that?" 68
"What do you want?" 100
"What is your name?" 70
"What's his (a stranger) name?" 71
"Where do you live?" 70
"Where do you want to go?", ... 100
"Where is ___?" 71
"Where is ___?" 100
"Where is the ___." 101
"Where is ___(out-of-sight person, activity or object)?" 71
White's Gestural System for Lower Extremities 15
"Who is that?" 68
"Who is this?" 74
Who?, Why?, Where? and How many? 119
word prediction programs 56, 61

word-prediction software 59
Words+, Inc 37
worksheet for analyzing signs 20
wrist flexion-extension 81
Writing with Symbols 26
Zygo Model 16C 36
Zygo Industries 36